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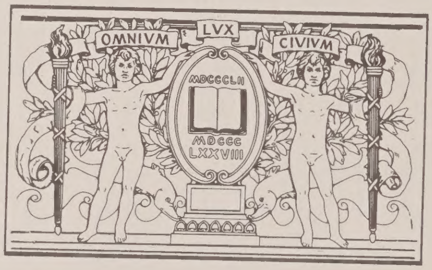

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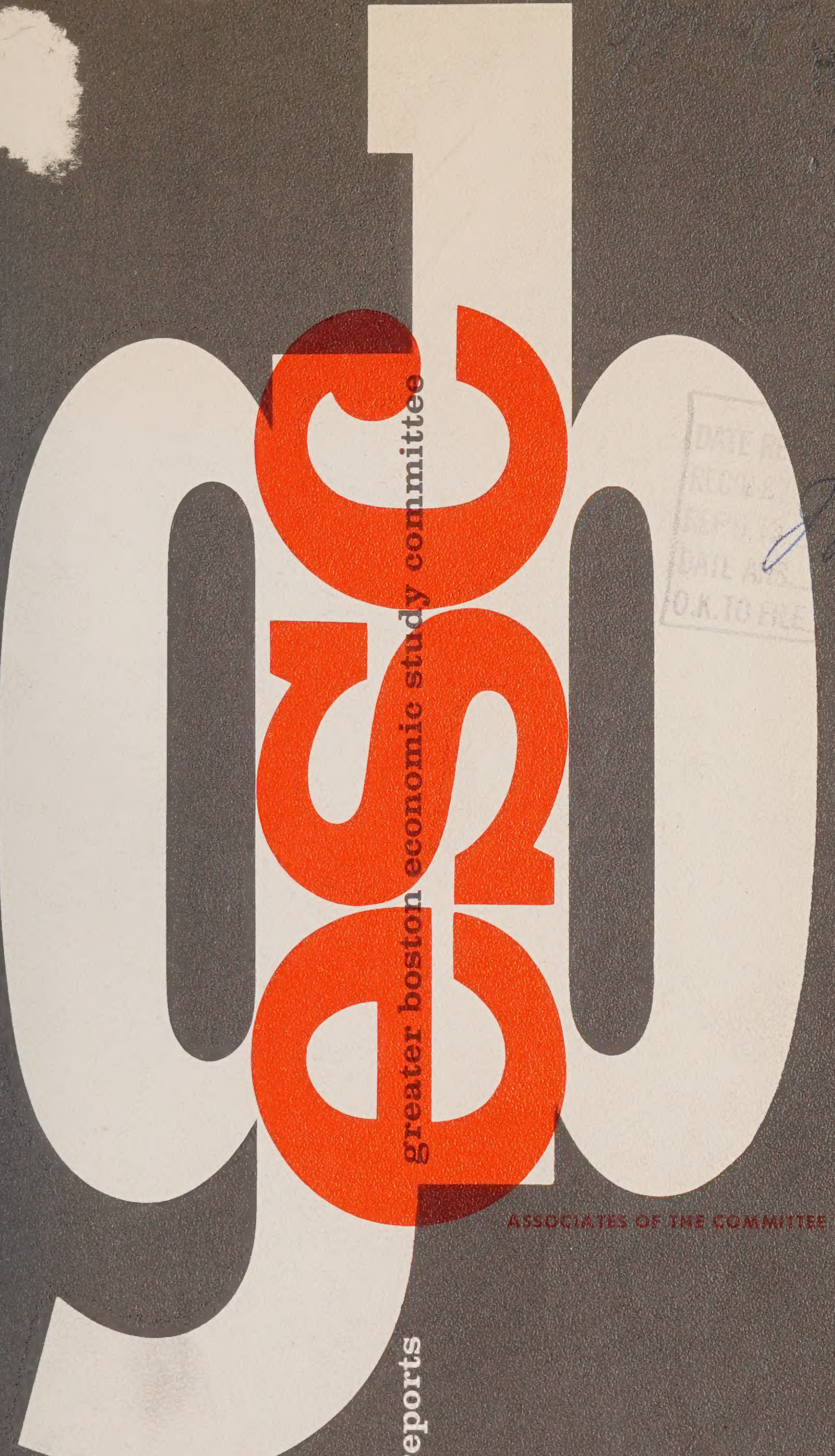

greater boston economic study committee

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economic base reports

business relocation caused by the boston central artery

6

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The Greater Boston Economic Study Committee was organized in 1957. The Committee presently has seventeen members--fourteen are businessmen, one is a newspaper editor, and two are the deans of schools of business administration. To help guide the work of the Committee, a Research Advisory Committee was appointed. This group consists of leading scholars and experts in metropolitan affairs. In 1959, the GBESC became Associates of the Committee for Economic Development. The GBESC feels that this association has helped to broaden its own metropolitan program and organization.

The GBESC has two objectives. One is to gather, organize and circulate basic economic data which will advance an understanding of the forces and trends operating in the metropolitan area. The other is to formulate policy recommendations which may both stimulate and advise leaders in metropolitan affairs.

The report presented here is based on A Study of Business Dislocations Caused by the Central Artery and a supporting survey of relocated businesses to determine their current circumstances and attitudes toward their relocation experience. This work was carried out by Mr. James H. Saalberg, a former Research Associate of the Greater Boston Economic Study Committee. Mr. Saalberg is presently a staff member of the Detroit City Planning Commission. In its original form, this study was accepted by the Massachusetts Institute of Technology in fulfillment of the requirements for the degree of Master in City Planning.

economic base report 6

business relocation caused by the boston central artery

April, 1960

greater boston economic study committee

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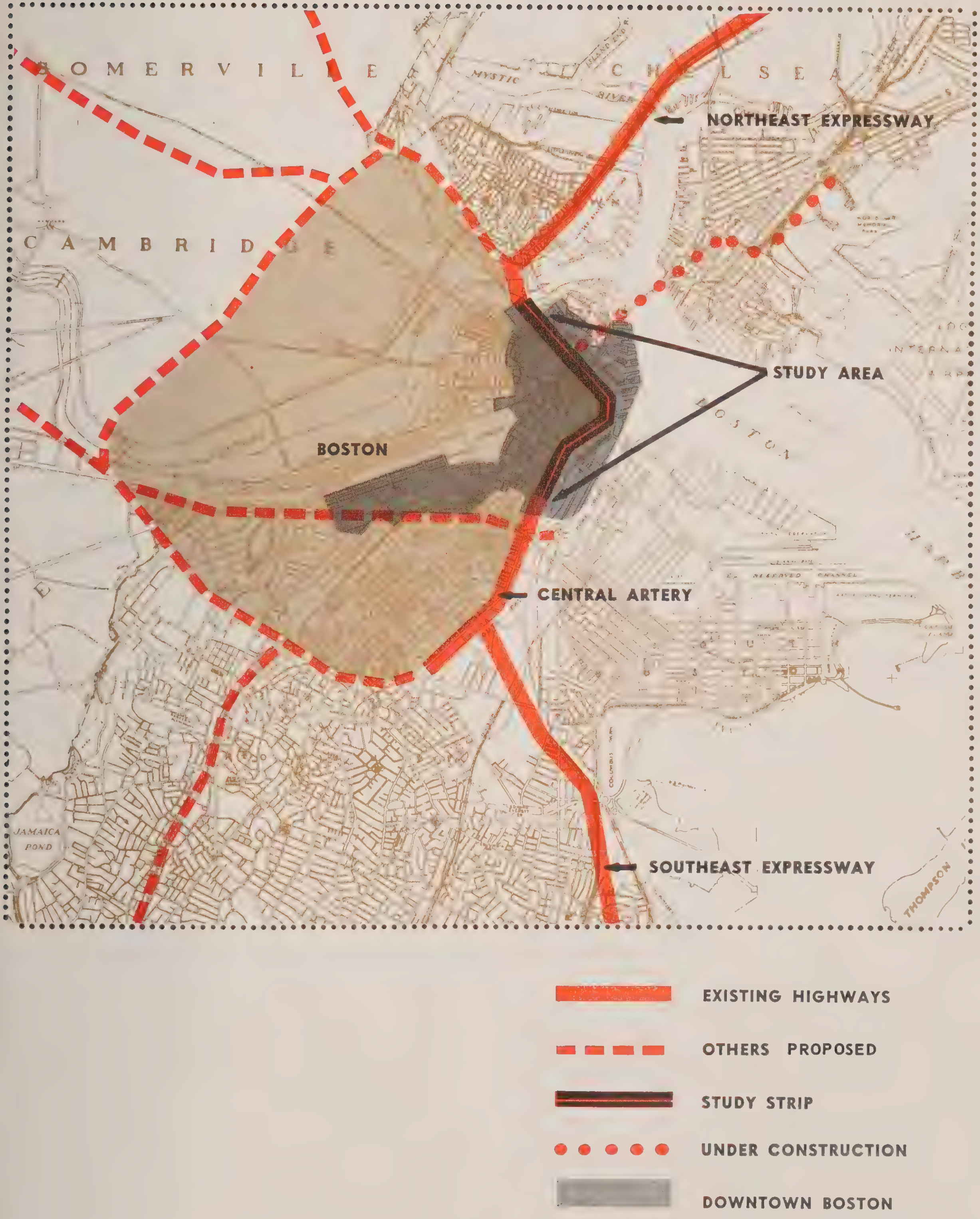
BUSINESS RELOCATION CAUSED BY THE BOSTON CENTRAL ARTERY

The Central Artery is approximately four miles long. It runs from Charlestown in the north to a point just below Boston's central business district where it connects with the Southeast Expressway. At present, the Artery serves two purposes: it accelerates traffic across the heart of the central business district by passing over and under the congestion of city streets, and by means of ramps to the street level, it is the principle distributor of traffic into Downtown Boston.

Eventually the Central Artery will assume a third function. When the planned Inner Belt is finally completed, the Central Artery and this new expressway will become a super highway circling the contiguous commercial and business cores of Boston and Cambridge.

This study is concerned with only that one and a half mile strip of the Central Artery which runs through Downtown Boston. At first elevated, this strip runs from the North Station along the eastern fringe of the central business district; it then proceeds underground for about a half mile and emerges at a point one and one-half miles short of its connection with the Southeast Expressway. This intown section of the Artery was built in two stages. The elevated portion was announced in 1950 and completed four years later. The underground stretch was delayed by controversy over its route. The controversy was not resolved until 1954 with the result that the tunnel section was not opened until the summer of 1959.

BOSTON'S INTOWN HIGHWAY SYSTEM: MAP 1



In its Report on Downtown Boston the Greater Boston Economic Study Committee noted that "a full assessment of downtown employment trends should distinguish between disruptions such as those caused by the construction of expressways and the slower evolutions induced by basic economic change." It promised a special study would undertake to measure "the extent and nature of change caused by the construction of the Central Artery." The main purpose of this report is to present the findings of that supplementary research.

Though limited in its original purpose, this survey of firms and employment uprooted by the Central Artery went well beyond a mere tally of displacements and survivals. It sought out the new locations of displaced firms and followed their business experience to 1957. In effect, the research asked a series of additional questions: Would all classes of industry displaced by the Central Artery have the same survival rates? Would all classes of industry have the same patterns of relocation? Which kinds of industry would seek to remain downtown, and which would migrate beyond the city? Was the pattern of survival, relocation and growth understandable in terms of the markets and technological characteristics of the firms displaced? In this way the Committee was afforded a unique opportunity, in a kind of controlled experiment, to test and verify its analysis of location requirements of downtown business presented in the Downtown Report.

A SUMMARY OF FINDINGS

Displaced Firms and Employment

The construction of the Boston Central Artery displaced 573 business firms employing 7, 160 persons.

These firms and employment represented 5 per cent of all downtown business activity and 2 per cent of all business activity in the City of Boston.

Most of the displaced business firms were engaged in light manufacturing or wholesaling activity, and most of them were small; over half had fewer than 6 employees.

Survival Among Displaced Firms and Employment

Eighty per cent of all displaced establishments survived, and these firms accounted for 90 per cent of all employment displaced by the Artery.

Survival rates were higher for large firms than for smaller ones.

In manufacturing, wholesaling, and service industries, about 85 per cent of all displaced firms survived; in retailing only about half relocated successfully.

Over 90 per cent of the employment in manufacturing, wholesaling, and service industries displaced by the Artery survived; in retailing, only 62 per cent survived.

Losses to the City of Boston were greater than those to the area as a whole. In addition to 118 liquidations, 35 firms migrated beyond the city limits.

Survival rates would probably have been greater if certain non-monetary help had been made available. The greatest need was for assistance in locating new sites, professional advice on tax and cost problems, and better explanations of municipal regulations.

Survival rates might possibly have been higher had the compensation paid to displaced firms included moving costs in addition to acquisition payments. In this way tenants as well as owners would have received financial aid.

The Pattern of Relocation

Two thirds of all relocating firms stayed in Downtown Boston. Over half of these firms had fewer than six employees.

About 20 per cent of the surviving firms moved into the industrial and commercial zone which adjoins Boston's central business district on its southern and eastern fringe. The remaining 15 per cent moved further out.

Retail and service establishments had the greatest preference for relocating downtown. Manufacturing and wholesaling firms took greater advantage of Artery displacement to relocate in a less congested environment.

Only two firms moved out of the Boston metropolitan area. None left the state.

Establishments that left Downtown Boston were on the average larger than those that remained. As a result, over half of the employment which survived Artery displacement was moved out of Downtown Boston.

Expansion and Decline in the Relocating Firms

As of 1957, employment growth in the relocating firms had completely offset all of the employment lost at the time of Artery displacement.

Among the major classes of industry, net employment increases occurred in manufacturing, wholesaling, and services. These increases offset declines in retailing, construction, trucking, and transportation.

The greatest employment increases occurred in the firms that relocated in the industrial-commercial area which adjoins the central business district. In the firms that relocated farther out, employment growth occurred at a slower rate. No growth whatsoever occurred in the firms that stayed downtown.

Manufacturers and wholesalers of meat products experienced the greatest gains. By 1957, employment in the relocated meat firms was 173 per cent greater than it had been in all meat firms at Artery sites. This increase represented a doubling of employment in the surviving establishments.

The greatest employment declines took place in the manufacturing and wholesaling of food other than meat and in retail activity.

As of 1957, Artery firms that relocated within the City of Boston had 668 fewer employees than did all of the firms that were originally located on Artery sites. Not all of this loss of employment in Boston can be attributed to Artery displacement however because employment in the city as a whole was generally declining in the period under review.

Thirty-five per cent of the business firms that answered a questionnaire on relocation experience reported business increases. Forty per cent reported no change, and 25 per cent indicated a decline.

Fifty per cent of the respondents preferred their new location; 25 per cent considered their new location inferior.

Of the firms reporting increases in business, about half attributed these increases directly to the superiority of their new locations.

RELOCATION EXPERIENCE: AN EVALUATION

One of the most important questions raised by Central Artery displacements was: How much economic activity was permanently lost? Measured in terms of employment, the Greater Boston area lost none. As of 1957, employment gains in relocated firms completely offset employment losses in the firms that failed to survive displacement.

The effect on the City of Boston alone was, however, somewhat different. A total of 153 firms were lost, 118 liquidated and 35 migrated into suburban cities. In addition, the city had lost as of 1957, about 700 jobs despite gains in firms that relocated in the city. On the other hand, many of the firms which failed were either marginal or poorly located at their Artery sites, and some firms, notably in the meat industry, improved their locations as a result of being displaced. Therefore, there is no doubt that the contribution the Artery makes to the Boston economy as an intown expressway and distributor of traffic to the downtown district far outweighs the loss of firms and employment it induced.

A second question raised by the construction was: Were business failures and employment losses kept to a minimum? This question is difficult to answer, but the findings of this research point to an affirmative conclusion. Survival rates for both firms and employment were high. But as further intown highway construction is planned, it is important to recognize and consider the merit of suggestions made by relocated

businessmen who favored additional forms of assistance over and above what they received. Although allowances for moving costs were uppermost, it is noteworthy that the next three most commonly favored forms of aid were non-monetary. These included help in finding new locations; assistance in analyzing building, land, and tax costs; and better explanations of municipal regulations. These suggested additions to current compensation payments could be helpful in reducing the rate of business failure in future highway renewal programs.

A third question raised by the Artery construction was whether or not the displacement of downtown business activity distorted land use patterns. The answer seems to be that it did not. A distortion would have occurred if the industry displaced had been forced into locations which were unsuited for it or into locations in which it was regarded as undesirable. In the Artery case, much of the displaced industry was able to relocate satisfactorily in a convenient industrial-commercial region adjacent to the downtown district. Therefore, there was no distortion in the regional land use pattern. But this result was a fortuitous one, and Artery experience suggests that future highway constructions should consider effects on land use more than they were considered in the present case.

Finally, the Artery experience implies the question: Is there any need to amend the renewal legislation that presently relates to highway

construction? The purpose of such amendment would be twofold: 1.) to minimize adverse effects of highway construction on land use patterns; and 2.) to minimize business failures due to displacement. Housing and industrial urban renewal programs achieve these objectives by requiring a plan for the relocation of displaced activities and by providing funds to defray relocation costs. The scope of this research will not permit us to recommend for or against specific changes in the law relating to the renewal of blighted areas through highway construction. Its findings suggest, however, that the law should be reexamined with a view to bringing all forms of urban renewal under a consistent program of legislation.

A NOTE ON RESEARCH METHODS

The following tables, maps, and analyses present in detail the findings of this research.

The main statistical source for this report was Massachusetts Division of Employment Security data. The Employment Security Law does not require the reporting of employment in agriculture, railroads, nonprofit institutions, and government. In addition, firms in which the proprietor is the sole employee are not covered under the Law.

A check of "noncovered" employment in agriculture, railroads, nonprofit institutions and government along the Artery route was made, but it was found to be insignificant. The omission of this data does therefore not distort the findings of this report in any way. There were, however, about 300 establishments in which the proprietor was the only employee. These firms were excluded from this analysis, and the report must be read with regard for this qualification.

All Artery firms were not displaced at the same time. It was therefore necessary to establish cut-off dates in order to compare employment in 1957 with Artery employment. Two dates were used. January 1, 1950, was chosen for those firms that were displaced from the section of the Artery running from the North Station to Fort Hill Square. January 1, 1954, was selected for the remaining section of

the Artery running to Harvard Street. These dates coincide roughly with the dates on which the official routes for these separate sections of the Artery were announced.

The use of these two cut-off dates raises a question of the comparability of employment displaced from the Central Artery and 1957 employment in surviving firms. A check of 1950 employment along that section of the Artery route for which the 1954 cut-off date was used showed the difference to be less than 1 per cent. It can be assumed therefore that the use of two cut-off dates did not introduce any significant error.

Finally, the Committee's Report on Downtown Boston noted that it was necessary to correct its statement of changes between 1947 and 1957 for the displacement caused by the Central Artery. Similarly, it must be pointed out that some of the decline described in this study would have occurred even if the Artery had not been built, as employment in Boston was declining generally in the period. This point is discussed in connection with Table XIV where city and Artery employment trends are compared.

TABLE I BUSINESS FIRMS AND EMPLOYMENT DISPLACED BY THE BOSTON CENTRAL ARTERY

Class of Industry	Firms Displaced	Percent Firms Displaced	Employment Displaced	Percent Employment Displaced
All Classes	573	100	7,160	100
Manufacturing	157	27	3,401	48
Meat	7	1	556	8
Other food	12	2	581	8
Apparel	29	5	717	10
Printing	36	6	701	10
Other nondurables	30	5	275	4
Metal products	25	4	358	5
Other durables	18	3	213	3
Wholesaling	242	42	2,445	34
Meat	29	5	631	9
Other food	56	10	501	7
Apparel	24	4	274	4
Metal products	65	11	524	7
Leather	38	7	247	3
Other	30	5	268	4
Retail	99	17	676	9
Services	47	8	371	5
Trucking and transportation	12	2	136	2
Construction	16	3	131	2

NOTES FOR TABLE I

The Boston Central Artery displaced 573 business establishments and 7,160 employees.

The fringe of the downtown district that was renewed by the Artery had been devoted mainly to wholesaling and light manufacturing. Some 70 per cent of all displaced firms had been engaged in one or the other of these two activities. In terms of employment, manufacturing and wholesaling were even more important in the area. Over 80 per cent of all displaced workers had been employed in displaced manufacturing and wholesaling establishments.

Another 25 per cent of the firms with about 15 per cent of the employment displaced were engaged in the retail and service industries. Trucking and transportation, and construction activity accounted for the remaining 5 per cent of all activity displaced by the construction of the Artery.

TABLE II CENTRAL ARTERY FIRMS AND EMPLOYMENT AS A PER CENT OF ALL SIMILAR FIRMS AND EMPLOYMENT IN DOWNTOWN BOSTON AND BOSTON CITY

Class of Industry	Artery Displacement as a Percent of All			
	Boston Firms	Boston Employment	Downtown Firms	Downtown Employment
All Classes	2	2	5	4
Manufacturing	5	3	11	10
Meat	20	23	35	42
Other food	5	4	20	31
Apparel	3	3	5	5
Printing	7	8	10	14
Other nondurables	5	2	15	4
Metal products	5	2	17	13
Other durables	5	2	17	21
Wholesaling	5	5	7	9
Food	11	11	20	26
Metal products	8	5	14	9
All other	4	3	5	6
Retail	1	1	5	2
Services	1	*	1	1
Trucking and transportation	2	1	10	5
Construction	1	1	5	1

* Less than one half of one per cent.

NOTES FOR TABLE II

Business firms and employment displaced by the Central Artery represented 2 per cent of all firms and employment in the city of Boston. For Boston's central business district alone, the proportion was 5 per cent.

Manufacturing and wholesaling were the most seriously affected, as activity displaced in these industries represented about 5 per cent for the city as a whole. In contrast, only about one per cent of Boston's retail, service, construction, trucking, and transportation industry was uprooted.

Among industrial subclasses the meat packing industry was the most seriously disrupted. About one in every five of Boston firms and employees was displaced by the Artery. A major displacement, about 10 per cent, also occurred in Boston's food wholesaling industry.

As about half of the city's firms and employment are concentrated in the central business district, displacement measured in terms of downtown activity alone is correspondingly greater. When all of the affected industries are taken as a group, the proportions displaced for firms and employment rise to 5 per cent and 4 per cent respectively. The proportions also rise for each industrial class as shown. The very high displacement rates for meat manufacturing reveal this industry to be the most seriously affected of all downtown industries disturbed by the construction of the Central Artery.

TABLE III A THE DISTRIBUTION BY SIZE OF FIRMS DISPLACED BY THE CENTRAL ARTERY

Number of Employees	Firms Displaced	Percent Firms	Employment Displaced	Percent Employment
0-4	264	46	578	8
5-9	136	24	884	12
10-19	91	16	1,249	17
20-49	54	9	1,625	23
50-99	20	3	1,308	18
over 99	8	1	1,516	21
Totals	573	100	7,160	100

TABLE III B THE MEDIAN SIZE OF FIRMS DISPLACED BY THE CENTRAL ARTERY

Class of Industry	Employees in Median Firm	Class of Industry	Employees in Median Firm
All Classes	5.8	Wholesaling	4.9
		Meat	12.3
Manufacturing	9.1	Other food	4.8
Meat	60.0	Apparel	4.0
Other food	9.9	Metal products	4.6
Apparel	15.0	Leather	3.8
Printing	9.9	Other	7.3
Other nondurables	5.6		
Metal products	7.9	Retail	4.6
Other durables	7.5		
		Services	4.2
Trucking and transportation	6.7	Construction	5.8

NOTES FOR TABLE III

Most of the 573 firms displaced were small. Over half of them had fewer than six employees, and as many as 400 of them had less then 10 workers. By employment, only one job in five was to be found in this relatively large group of relatively small firms.

Among large firms, only 8 had a hundred or more employees, and only 28 had as many as 50 workers. Though few in number, firms with over 50 employees accounted for 40 per cent of all displaced employment.

Manufacturing firms tended to be larger than average, as the median firm in this category had more than nine workers. The largest firms were in meat packing, where the median firm of seven establishments had 60 workers.

Retail sales and service establishments were smallest. Half of them had fewer than five workers.

TABLE IV SURVIVAL RATES FOR FIRMS AND EMPLOYMENT DISPLACED BY THE CENTRAL ARTERY

Class of Industry	Firms			Employment		
	Displaced	Surviving	% Surviving	Displaced	Surviving	% Surviving
All Classes	573	455	79	7,160	6,369	89
Manufacturing	157	135	86	3,401	3,163	93
Meat	7	6	86	556	476	86
Other food	12	7	58	581	560	96
Apparel	29	25	86	717	619	86
Printing	36	35	97	701	700	100
Other nondurables	30	25	83	275	248	90
Metal products	25	22	88	358	352	98
Other durables	18	15	83	213	208	98
Wholesaling	242	205	85	2,445	2,229	91
Meat	29	24	83	631	587	93
Other food	56	42	75	501	426	85
Apparel	24	23	96	274	256	93
Metal products	65	55	85	524	481	92
Leather	38	35	92	247	238	96
Other	30	26	87	268	241	90
Retail	99	55	56	676	422	62
Services	47	41	87	371	349	94
Trucking and transportation	12	9	75	136	132	97
Construction	16	10	63	131	74	56

NOTES FOR TABLE IV

Eighty per cent of all displaced firms and 90 per cent of all displaced employment survived.

Manufacturing and wholesaling had higher than average survival rates. The printing industry, for example, lost only one of the 36 establishments that were displaced by the Artery. The single exception to the very high survival rate in manufacturing and wholesaling was in food other than meat. In this category, however, the firms that failed were small. As a result, relocating firms manufacturing food products other than meat accounted for 85 per cent of all employment displaced in this industry.

Service industries also had very high survival rates as did trucking and transportation. In both cases, rates were somewhat higher for employment than for firms.

In retailing, the sales of the small establishments along the Artery route were based on long standing and close contacts between the retailer and his customers in the immediate neighborhood. In many instances, Artery displacement not only put an end to these close customer contacts by uprooting the retailer, but it often dispersed the customers as well. As might have been expected, therefore, retailers displaced by the Artery had the lowest survival rate.

TABLE V A THE DISTRIBUTION BY SIZE OF FIRMS SURVIVING DISPLACEMENT BY THE CENTRAL ARTERY

Number of Employees	Firms Displaced	Firms Surviving	Percent Firms Surviving	Employment Displaced	Employment Surviving	Percent Employment Surviving
0-4	264	193	73	578	432	75
5-9	136	111	82	884	726	82
10-19	91	76	84	1,249	1,050	84
20-49	54	49	91	1,625	1,487	92
50-99	20	18	90	1,308	1,158	89
over 99	8	8	100	1,516	1,516	100
Totals	573	455	79	7,160	6,369	89

TABLE V B THE MEDIAN SIZE OF FIRMS SURVIVING DISPLACEMENT BY THE CENTRAL ARTERY

Class of Industry	Employees in Median Firm	Class of Industry	Employees in Median Firm
All Classes	6.6	Wholesaling	5.2
		Meat	12.5
Manufacturing	9.9	Other food	4.9
Meat	49.0	Apparel	3.8
Other food	27.5	Metal Products	4.9
Apparel	15.8	Leather	4.0
Printing	10.5	Other	7.2
Other nondurables	6.1		
Metal products	9.2	Retail	4.8
Other durables	8.8		
		Services	4.3
Trucking and transportation	9.2	Construction	7.5

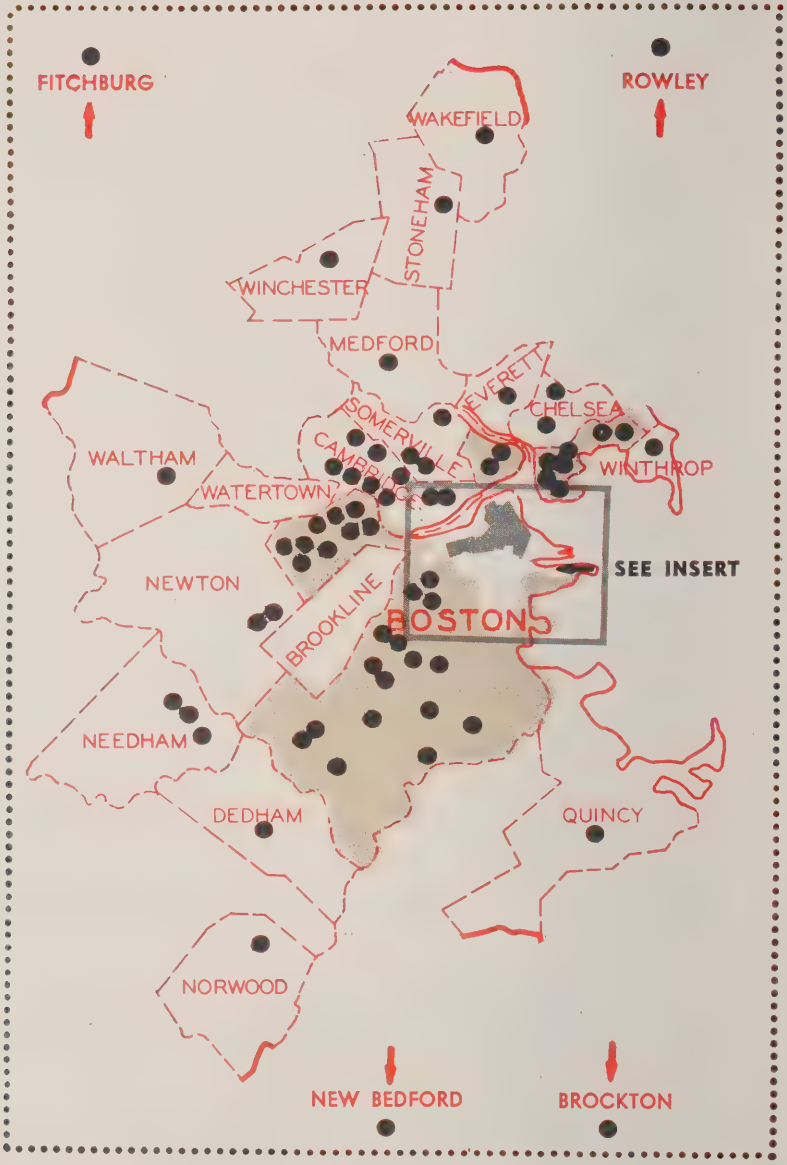
NOTES FOR TABLE V

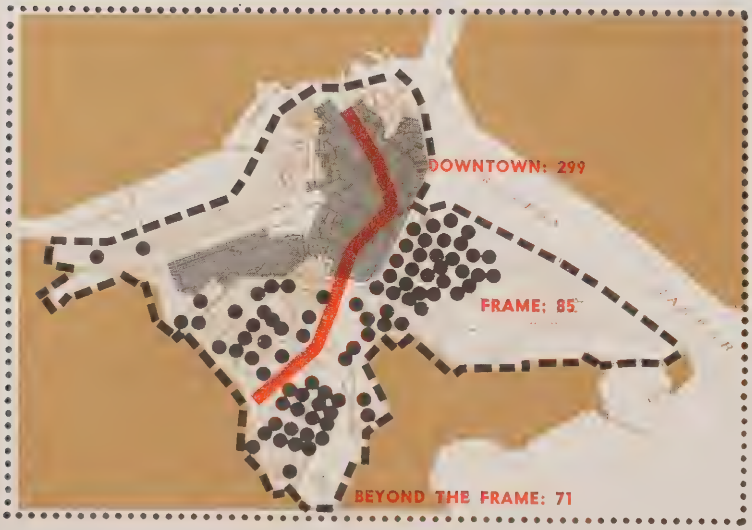
The median firms of all surviving establishments had 6.6 employees. As shown in Table III B, there had been only 5.8 workers in the median firm of the original Artery group. A comparison of the median size of displaced and surviving firms, Table III B and V B, shows that it was the smaller firms that fell by the wayside. There are only 3 unimportant exceptions to this pattern.

Survival rates by size of firm alone, that is without any regard to industrial classification, confirm the greater capacity of larger firms to survive.

There were 264 establishments, each with less than five employees. As a group, they had 518 workers. Of these firms, 73 per cent survived, and they took with them 75 per cent of their overall employment. In contrast, establishments with between 50 and 100 employees had survival rates of 90 per cent, while no firms of over 100 employees were forced to liquidate due to Artery displacement.

RELOCATION PATTERN OF SURVIVING ARTERY FIRMS: MAP 2





NOTES FOR FIGURE II

Two thirds of the displaced business establishments relocated in Downtown Boston.[1] Of these, 90 per cent moved to new sites within one quarter of a mile of the Central Artery.

Another 20 per cent of the firms moved into the relatively small area which extends about two miles to the east and south of Downtown Boston. This region is predominantly a commercial, wholesale, and industrial area, and it blends into the residential district beyond. A transitional zone such as this one appears to exist on the edge of central business districts in all large cities. The phrase, "frame of the downtown district", is widely used to describe it.[2] This term, or its shortened version, "the frame", will be used in this report.

Almost all of the remaining firms moved into the environs beyond the frame. Included in this area is the rest of the City of Boston and the 20 cities and towns, each of which attracted one or more of the displaced firms.

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[1] The term, "Downtown Boston," as used in this report is identical to its use in the GBESC study, A Report on Downtown Boston.

[2] See for example, Chapter 2, The CBD Frame Concept in Studies of the Central Business District and Urban Freeway Development, by Edgar M. Horwood and Ronald R. Boyce, University of Washington Press, 1959.

TABLE VI FIRMS AND EMPLOYMENT LOST TO BOSTON CITY AT THE TIME OF CENTRAL ARTERY DISPLACEMENT

Class of Industry	Firms Lost			Employment Lost		
	Total	Liquidated	Moved Out	Total	Liquidated	Moved Out
All Classes	153	118	35	1,348	791	557
Manufacturing	32	22	10	539	238	301
Meat	2	1	1	120	80	40
Other food	5	5	0	21	21	0
Apparel	5	4	1	137	98	39
Printing	2	1	1	35	1	34
Other nondurables	8	5	3	56	27	29
Metal products	6	3	3	162	6	156
Other durables	4	3	1	8	5	3
Wholesaling	54	37	17	441	216	225
Meat	6	5	1	46	44	2
Other food	17	14	3	105	75	30
Apparel	3	1	2	33	18	15
Metal products	18	10	8	205	43	162
Leather	4	3	1	10	9	1
Other	6	4	2	42	27	15
Retail	47	44	3	270	254	16
Services	10	6	4	34	22	12
Trucking and transportation	4	3	1	7	4	3
Construction	6	6	0	57	57	0

NOTES FOR TABLE VI

An important result of the forced relocation of Artery firms was that firms and employment were redistributed between Boston and its neighboring cities. Losses to Boston therefore exceeded losses to the metropolitan area. Although only 118 firms failed, Boston lost 153. The additional 35 migrated beyond the city's limits and were distributed among 20 cities and towns.

Manufacturing, wholesaling, and retailing accounted for 133 of the 153 firms lost to the city. There was, however, a considerable variation among industrial classes in the ratio of loss through liquidation to loss by migration. In manufacturing, for example, the ratio was about one migrant for every two business liquidations. In retailing on the other hand, business failure accounted for over 90 per cent of all firms lost to Boston.

In very few cases did migrations exceed or equal liquidations, and these were in classes where the total number of firms lost was relatively small. As a result, it is possible to conclude that the basic pattern in the loss of business establishments to the city was set by the pattern of liquidations.

The pattern for losses of employment to Boston is quite different from the pattern for loss of firms. As firms that migrated beyond the city were larger than average, they took with them a disproportionately large share of the displaced employment. As a result, employment taken out of the city represented 40 per cent of all jobs lost in Boston due to Artery displacement.

In manufacturing and wholesaling for example, employment migrations exceeded liquidations. In retailing where firms either liquidated or relocated very close to the Artery, very few jobs were taken out of the city.

TABLE VII THE RELOCATION OF SURVIVING FIRMS

Class of Industry	Firms Relocating	Stayed Downtown	Moved into the Frame	Moved Beyond the Frame	Percent Staying Downtown	Percent Into the Frame	Percent Beyond the Frame
All Classes	455	299	85	71	66	19	15
Manufacturing	135	81	32	22	60	24	16
Meat	6	2	2	2	33	33	33
Other food	7	4	1	2	57	14	29
Apparel	25	22	2	1	88	8	4
Printing	35	20	13	2	57	37	6
Other nondurables	25	15	4	6	60	16	24
Metal products	22	9	7	6	41	32	27
Other durables	15	9	3	3	60	20	20
Wholesaling	205	130	39	36	63	19	18
Meat	24	5	15	4	21	62	17
Other food	42	33	3	6	79	7	14
Apparel	23	19	2	2	82	9	9
Metal products	55	26	13	16	47	24	29
Leather	35	31	2	2	88	6	6
Other	26	16	4	6	62	15	23
Retail	55	48	2	5	87	4	9
Services	41	32	5	4	78	12	10
Trucking and transportation	9	5	2	2	56	22	22
Construction	10	3	5	2	30	50	20

NOTES FOR TABLE VII

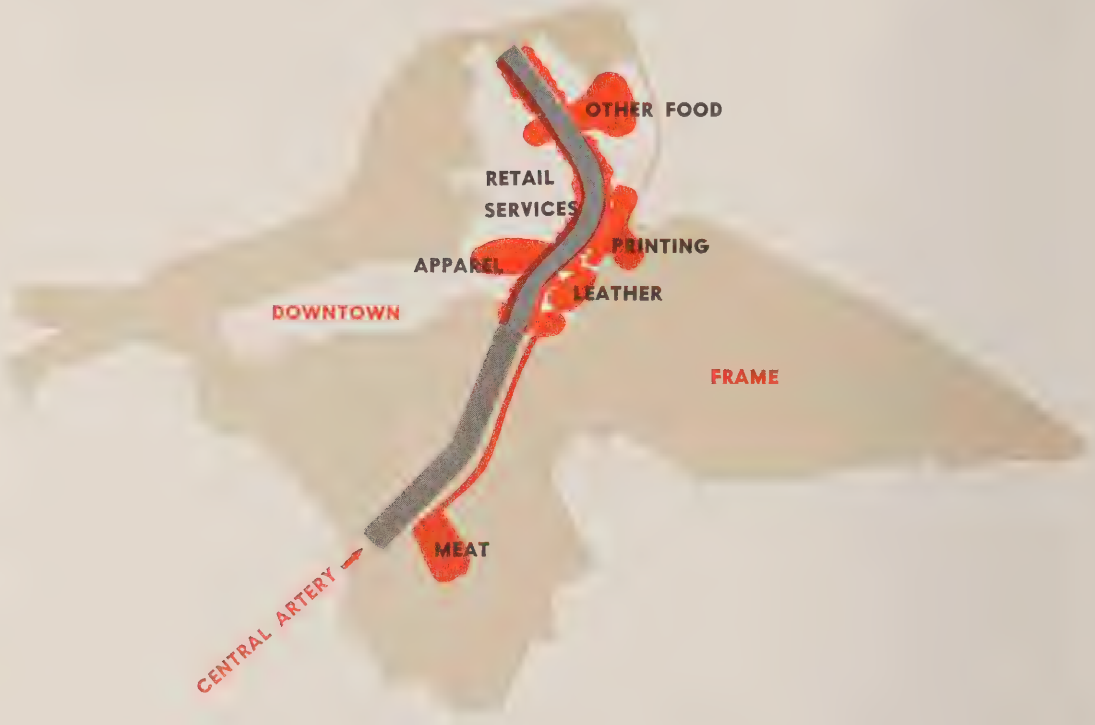
While two thirds of all relocating firms remained downtown, there was a considerably deviation from this proportion among the classes of industry. In manufacturing and wholesaling, only 60 per cent relocated in the central business district; in retailing, 87 per cent; and in services, 78 per cent.

Within manufacturing and wholesaling, there were further deviations from the average. Less than 25 per cent of all surviving meat packers and wholesalers remained downtown. In contrast, 85 per cent of all relocating firms in the apparel industry and about 80 per cent of the surviving leather and "other food" wholesalers remained in the central business district.

Substantial percentage variations also appear for the 'frame". These are, however, difficult to interpret because the number of firms relocating there was relatively small. The significance of relocation in the "frame" is clarified when these moves are taken in the context of the trend of the industry. For example, the printers' downtown preference is shown by the fact that 33 of 35 relocating firms either stayed downtown or moved into the "frame". In contrast, the meat industry showed its aversion for the core district. Of 30 displaced firms, 17 moved into the "frame" and 6 more located still further out.

Only 71 of all relocating firms moved beyond the "frame".

CONCENTRATION AND DISPERSION IN RELOCATED INDUSTRY: MAP 3



	RETAIL	MEAT	APPAREL	SERVICES	LEATHER	OTHER FOOD	PRINTING
STAYED DOWNTOWN	87%	23%	86%	78%	88%	76%	57%
MOVED TO FRAME	4%	57%	8%	12%	6%	8%	37%
MOVED BEYOND FRAME	9%	20%	6%	10%	6%	16%	6%

NOTES FOR FIGURE III

As shown in Figure II, the 71 firms that relocated beyond the frame were widely dispersed in Boston and among 20 adjacent cities. In contrast, some of the firms that relocated downtown or moved into the frame showed a marked tendency to cluster.

Some firms gravitated to existing centers of similar activity either downtown or at the edge of the downtown district. The clusters of relocated firms in apparel, other food, and leather are of this kind.

In other industries, a mass relocation of firms took place, and new clusters were formed further out in the frame. The meat and printing concentrations shown in Figure III are of this second kind.

While firms in the retailing and service industries did not move far from their original Artery sites, there was no marked tendency to cluster. Instead, most of these firms relocated along the Artery to a depth of about one quarter of a mile on either side.

TABLE VIII THE RELOCATION OF SURVIVING EMPLOYMENT

Class of Industry	Employment Relocating	Stayed Downtown	Moved into the Frame	Moved Beyond the Frame	Percent Staying Downtown	Percent Into the Frame	Percent Beyond the Frame
All Classes	6,369	2,979	2,029	1,361	47	32	21
Manufacturing	3,163	1,261	1,224	678	40	39	21
Meat	476	100	329	47	21	69	10
Other food	560	146	368	46	26	66	8
Apparel	619	536	44	39	87	7	6
Printing	700	156	280	264	22	40	38
Other nondurables	248	110	90	48	44	36	20
Metal products	352	79	74	199	22	21	57
Other durables	208	134	39	35	64	19	17
Wholesaling	2,229	930	676	623	42	30	28
Meat	587	47	444	96	8	76	16
Other food	426	334	41	51	78	10	12
Apparel	256	181	60	15	71	23	6
Metal products	481	116	81	284	24	17	59
Leather	238	149	13	76	63	5	32
Other	241	103	37	101	43	15	42
Retail	422	397	4	21	94	1	5
Services	349	282	55	12	81	16	3
Trucking and transportation	132	85	31	16	64	24	12
Construction	74	24	39	11	32	53	15

NOTES FOR TABLE VIII

Displaced employment was redistributed among the sectors in proportions that differed from those for the redistribution of displaced firms. A smaller proportion of the employment relocated in Downtown Boston and correspondingly larger shares moved into the "frame" and the area beyond. To compare: 47 per cent of all relocating employment remained downtown, 32 per cent went into "the frame" and 21 per cent migrated into the outlying district. By firms, these proportions were 66, 19, and 15 per cent respectively.

Major industrial classes and their subclasses deviated considerably from these averages in their pattern of relocation. A greater than average share, 60 per cent, of all relocated manufacturing and wholesaling employment left the downtown district. In retailing, on the other hand, almost all surviving employment stayed downtown, and in services the downtown share was just over 80 per cent.

Among the subclasses, apparel and "other food" wholesaling showed the strongest preferences for a downtown relocation. In the meat industry the preference was for the "frame" as 70 per cent of all displaced employment moved into this sector. Two thirds of all displaced employment engaged in the manufacturing of food other than meat also was moved into the "frame", but this figure is somewhat misleading, as it reflected mainly the movement of a single large business establishment.

Only in the case of metal products did the region beyond the frame attract more than 50 per cent of all displaced employment.

TABLE IX THE MEDIAN SIZE OF SURVIVING FIRMS STAYING DOWNTOWN, MOVING INTO THE FRAME, AND MOVING BEYOND THE FRAME

Class of Industry	Surviving Firms	Staying Downtown	Moving into the Frame	Moving Beyond the Frame
All Classes	6.6	5.2	9.3	9.3
Manufacturing	9.9	8.6	15.7	16.7
Meat	49.0	--	--	--
Other food	27.5	--	--	--
Apparel	15.8	15.0	--	--
Printing	10.5	7.1	16.0	--
Other nondurables	6.1	5.5	--	7.5
Metal products	9.2	6.3	7.5	19.9
Other durables	8.8	8.1	--	--
Wholesaling	5.2	4.2	8.0	10.9
Meat	12.5	7.5	12.5	--
Other food	4.9	5.3	--	4.9
Apparel	3.8	3.7	--	--
Metal products	4.9	3.4	4.6	11.7
Leather	4.0	3.7	--	--
Other	7.2	6.0	--	9.9
Retail	4.8	4.9	--	4.2
Services	4.3	4.2	7.5	--
Trucking and transportation	9.2	8.5	--	--
Construction	7.5	7.5	7.5	--

Note: No medians were computed when there were less than five firms in the class.

NOTES FOR TABLE IX

An implication of the differences in the proportions for firms and employment shat stayed downtown, moved into the "frame", and moved beyond, as shown in Tables VII and VIII respectively is that it was the larger firms that moved out of the downtown area. To the extent that median averages permit, this is made explicit in Table IX.

The median size of all displaced firms was 6.6 employees. The median size of the firms staying downtown was, however, 5.2, while the median size of those moving out of the downtown area was 9.3 employees.

This basic pattern is maintained throughout. In manufacturing and wholesaling for example, the median size of all displaced firms was 9.9 employees, while the median firm moving outside the downtown area was 16.7. The average for those manufacturers and wholesalers that stayed downtown was 8.5 workers.

Retailing and other food wholesaling appear to refute the basic pattern. But in these cases, the median is calculated from only a few observations and its usefulness as a measure is impaired. In the case of retailing, only five firms moved beyond the frame, and in the case of food wholesaling, there were only 6.

TABLE X EMPLOYMENT CHANGES IN THE FIRMS SURVIVING ARTERY DISPLACEMENT

Class of Industry	Displaced Artery Employment	Employment Lost in Liquidated Artery Firms	Employment Added in Relocated Artery Firms	Employment in Relocated Firms 1957	Net Employment Change Col. 4 - Col. 1 or Col. 3 - Col. 2
All Classes	7,160	791	824	7,193	33
Manufacturing	3,401	238	442	3,605	204
Meat	556	80	558	1,034	478
Other food	581	21	-256	304	-277
Apparel	717	98	109	728	11
Printing	701	1	56	756	55
Other nondurables	275	27	- 15	233	- 42
Metal products	358	6	14	366	8
Other durables	213	5	- 24	184	- 29
Wholesaling	2,445	216	472	2,701	256
Meat	631	44	434	1,021	390
Other food	501	75	- 3	423	- 78
Apparel	274	18	- 48	208	- 66
Metal products	524	43	62	543	19
Leather	247	9	19	257	10
Other	268	27	8	249	- 19
Retail	676	254	- 95	327	-349
Services	371	22	40	389	18
Trucking and transportation	136	4	- 27	105	- 31

NOTES FOR TABLE X

By 1957, employment growth in the relocating firms completely offset the losses incurred at the time of Artery displacement. Eight hundred and twenty-four jobs were added; 791 had been lost.

While this net gain of 33 jobs is insignificant, there were some important gains and losses for individual classes of industry. By 1957, the net increase in manufacturing employment was over 200 jobs, and in wholesaling, over 250. In the service industries both losses and subsequent gains were small and overall employment changed very little. In contrast, employment in retailing, construction, trucking, and transportation declined in the period after displacement. In retailing, where 254 jobs were liquidated at the time of displacement, another 95 were lost in the subsequent period.

It is the meat industry, however, that stands apart from all others in its growth experience. At Artery sites there had been 1,187 employees working in 36 establishments. Six firms failed to survive displacement, reducing the industry's employment by 124 jobs. But by 1957 surviving firms added 992 jobs for a net gain of 868 over original Artery employment. This represented a net increase of almost 75 per cent. As there is no evidence to suggest that these firms would have relocated in the normal course of events, Artery displacement and forced relocation proved a blessing in disguise for the meat industry.

TABLE XI PER CENT EMPLOYMENT CHANGES IN THE FIRMS SURVIVING ARTERY DISPLACEMENT

Class of Industry	Percent Artery Employment Liquidated	Percent Employment Added in Surviving Firms	Percent Change From Original Artery Employment
All Classes	11.0	12.9	0.5
Manufacturing	7.0	14.0	6.0
Meat	14.4	117.2	86.0
Other food	3.6	-45.7	-47.7
Apparel	13.7	17.6	1.5
Printing	0.1	8.0	7.8
Other nondurables	9.8	- 6.0	-15.3
Metal products	1.7	4.0	2.2
Other durables	2.3	-11.5	-13.6
Wholesaling	8.8	21.2	10.5
Meat	7.0	73.9	61.8
Other food	15.0	- 0.7	-15.6
Apparel	6.6	-18.8	-24.1
Metal products	8.2	12.9	3.6
Leather	3.6	8.0	4.0
Other	10.1	3.3	- 7.1
Retail	37.6	-22.5	-51.6
Services	5.9	11.5	4.9
Trucking and transportation	2.9	-20.5	22.8
Construction	43.5	-10.8	-49.6

NOTES FOR TABLE XI

Per cent changes in employment show the variations in business experience after relocation more vividly than do the absolute changes of Table X.

Overall, employment in the surviving firms increased by about 13 per cent. As a result, employment in these firms was 0.5 per cent greater than it had been in all firms displaced from Artery sites.

Among the major classes, significant expansions occurred in relocated manufacturing with 14 per cent and in relocated wholesaling with 21 per cent. Retailers on the other hand not only failed to grow after relocation, they suffered an additional 22 per cent decline by 1957. As a result of these changes, manufacturing employment in relocated firms was 6 per cent higher than in all the original Artery firms, 10 per cent in wholesaling, but 50 per cent less in retailing.

Relocated service establishments increased their employment by 11.4 per cent, and as a result, the net change from the original Artery level was 4.9 per cent.

TABLE XII EMPLOYMENT GROWTH IN FIRMS RELOCATING IN DOWNTOWN BOSTON, THE FRAME, AND THE AREA BEYOND THE FRAME

Class of Industry	Total Employment Growth	Growth in		
		Downtown Boston	the Frame	the Area Beyond Frame
All Classes	824	- 3	654	173
Manufacturing	442	125	231	86
Meat	558	137	360	61
Other food	-256	-71	-184	-1
Apparel	109	86	17	6
Printing	56	8	78	-30
Other nondurables	- 15	-16	- 16	17
Metal products	14	-21	- 5	40
Other durables	- 24	2	- 19	- 7
Wholesaling	472	-41	419	94
Meat	434	- 4	379	59
Other food	- 3	-15	12	0
Apparel	- 48	-25	- 19	- 4
Metal products	62	0	23	39
Leather	19	16	5	- 2
Other	8	-13	19	2
Retail	- 95	-98	2	1
Services	40	32	6	2
Trucking and transportation	- 27	-13	- 3	-11
Construction	- 8	- 8	- 1	1

Three characteristics dominated the distribution of employment growth in the relocated firms. First, the greatest absolute and relative growth took place in the frame; second, in each of the sectors, growth was almost entirely confined to manufacturing and wholesaling activity; and third, within these major classes, "meat" dominated employment expansions.

As a group, the firms relocating downtown experienced almost no growth whatsoever. All major classes showed a decline except manufacturing and services, and in manufacturing it was meat and apparel that accounted for almost all of the growth. While the greater gain came in meat, growth in apparel was noteworthy. The downtown expansions accounted for 86 of the 109 apparel jobs added in the relocating firms.

Growth in the frame was much more general. By 1957, firms moving into this area added 654 jobs for a 30 per cent increase over their Artery level of employment. In manufacturing and wholesaling alone, 650 jobs were added. It was in the frame, however, that the meat industry had its greatest growth as employment in meat packing and wholesaling together expanded by over 700 jobs in this area.

Growth beyond the frame occurred at a rate about half that for the frame. Basically, it represented continuation of the pattern established in the area nearer the downtown district. Manufacturing and wholesaling categories once accounted for virtually all of the expansion. "Meat" was again the leader. The decline in printing occurred when one of the firms that moved out of the city subsequently went out of business.

TABLE XIII NET EMPLOYMENT CHANGE IN BOSTON CITY IN FIRMS DISPLACED BY THE CENTRAL ARTERY

Class of Industry	Displaced Artery Employment Liquidated or Leaving Boston	Employment Growth in Firms Relocating in Boston	Net Employment Change in Boston
All Classes	1,348	680	-668
Manufacturing	539	323	-216
Meat	120	507	387
Other food	21	-256	-277
Apparel	137	103	- 34
Printing	35	35	0
Other nondurables	56	- 21	- 77
Metal products	162	- 22	-184
Other durables	8	- 23	- 31
Wholesaling	441	446	5
Meat	46	432	386
Other food	105	- 9	-114
Apparel	33	- 33	- 66
Metal products	205	35	-170
Leather	10	16	6
Other	42	5	- 37
Retail	270	- 92	-362
Services	34	38	4
Trucking and transportation	7	- 27	- 34
Construction	57	- 8	- 65

NOTES FOR TABLE XIII

In 1957, employment in firms relocating in Boston was 9 per cent less than it had been in all the firms displaced from Artery sites.

Boston lost 1,348 jobs in the 153 firms that either liquidated or migrated out. By 1957, there was an offsetting increase of 680 employees in the firms that remained in the city. The result was a net loss of 668 jobs in Boston as a result of Artery displacement.

There was, as usual, a considerable variation among the major classes and subclasses of activity. Manufacturing and retailing were relatively heavy losers. Wholesaling remained unchanged. Among subclasses, the meat industry gained heavily, while other food and metal products led employment declines in the city.

An important feature of the losses to the city was that the declines took place despite the fact that about 90 per cent of all surviving firms and employment relocated there. The city found itself in a disadvantageous position in two respects. As large firms tended to move further out than small ones, the city lost a disproportionate share of employment at the outset. And second, as either no growth or declines occurred in many firms that remained in the city, the fact that 90 per cent of all surviving firms relocated there was insufficient to insure the recovery of employment lost due to Artery displacement.

TABLE XIV PERCENT EMPLOYMENT CHANGES IN ARTERY FIRMS RELOCATING IN BOSTON CITY AND IN ALL SIMILAR FIRMS IN BOSTON CITY*

Class of Industry	Percent Employment Changes in Artery Firms Relocating in Boston	Percent Employment Changes in All Firms in Boston
All displaced classes	- 9	- 3
Manufacturing	- 6	-15
Meat	70	9
Other food	-48	-11
Apparel	- 5	-14
Printing	0	- 5
Other nondurables	-26	-27
Metal products	-51	-10
Other durables	-15	-10
Wholesaling	**	- 4
Food	19	- 6
Metal products	-24	-11
Other	- 9	- 2
Retail	-54	-12
Services	1	17
Trucking and transportation	-21	- 4
Construction	-50	- 8

* As noted in the statement on research methods, percent employment changes for Artery firms are between 1950 or 1954 and 1957. "In the City" changes are measured between 1950 and 1957.

** Less than one half of one per cent.

NOTES FOR TABLE XIV

Though Boston lost 9 per cent of all Artery employment, some decline would have occurred without displacement. Employment was generally declining in the city, and between 1950 and 1957 it was at a rate of 3 per cent.

Manufacturing employment is exceptional in that Artery firms show a smaller rate of decline than do all firms in the city. Boston lost 15 per cent of its manufacturing employment during the period as against a decline of only 6 per cent for Artery firms. Growth in relocated meat industry firms, achieved at new and superior locations in the city, reduced the overall rate of decline in displaced manufacturing employment.

In wholesaling, employment experience was similar. Whereas all of the city's firms declined 4 per cent, employment expansions in displaced food wholesaling firms wiped out all of the original Artery losses. In retailing, the net loss for Artery firms was 54 per cent. This far exceeded Boston's average rate of decline of 12 per cent.

There is, however, no doubt that the Artery displacement accelerated the loss of employment in Boston. Between 1950 and 1957, 12,000 jobs were lost in the city. Artery losses account for 5.5 per cent of this total. As Artery employment accounted for only 2 per cent of city employment, the Artery decline is disproportionately high. It must be emphasized, however, that this slight acceleration in the rate of loss to the city was due to declines in small scale retailing, construction, trucking, and transportation. And there is evidence to suggest that many of these firms were either marginal or poorly located at their Artery sites.

TABLE XV A SURVEY OF ATTITUDES AMONG RELOCATED BUSINESSMEN

A. EVALUATION OF NEW LOCATIONS:

Class of Industry	Number Reporting	Percent Reporting		
		Better	Same	Worse
All Classes	143	47	27	26
Manufacturing	43	54	22	24
Wholesaling	66	42	36	22
Other	34	40	26	34

B. EVALUATIONS OF NEW LOCATIONS BY AREA:

New Location	Percent Reporting		
	Better	Same	Worse
Downtown Boston	40	32	28
Outside Downtown Boston	60	19	21

C. CHANGES IN DOLLAR VOLUME OF BUSINESS:

Activity	Percent Reporting		
	Increase	Same	Decrease
All Classes	34	41	26
Manufacturing	49	28	23
Wholesaling	29	47	24
Other	24	44	32

D. ADDITIONAL ASSISTANCE FAVORED BY INTERVIEWED BUSINESSMEN:

Type of Aid	Percent Favoring
Direct money payments for moving expenses	74
Help in finding a new location	65
Help in analyzing building, renting and tax costs	58
Better explanations of municipal regulations	52

NOTES FOR TABLE XV

A. Of 143 businessmen who responded to the questionnaire, almost 50 per cent preferred their new locations to their old ones. In manufacturing the proportion was even higher, 54 per cent. In wholesaling, the preference was not quite as great, as only 42 per cent of the respondents considered their new location superior to their old. Among others who reported, there was a relatively high proportion, 34 per cent, who reported their new site inferior.

B. There was a substantial difference in the evaluation of new locations on the part of those who stayed downtown as against those who moved away from Downtown Boston. Only 40 per cent of those remaining downtown thought their new location superior to their old. In contrast, 60 per cent of those who moved out preferred their new sites. Of respondents who stayed downtown, about one third found no difference between their old and their new locations.

C. One third of all firms reporting on their dollar volume of business reported increases at their new locations. Manufacturers fared better than average, as about 50 per cent reported favorably. Among wholesalers and others just over 50 per cent reported no change in their dollar volume. Only a few firms attempted to associate changes in the dollar volume with changes in location. But among those who did, 50 per cent of those experiencing increases in business attributed them to their new locations, while 70 per cent of those experiencing declines ascribed them to displacement.

D. Although survival rates were relatively high, most businessmen felt that additional kinds of assistance should have been given. While the suggestion ranking first implied additional payments to displaced firms, the next three were non-monetary in character. It is noteworthy that over 50 per cent of those responding suggested better explanations of municipal regulations.

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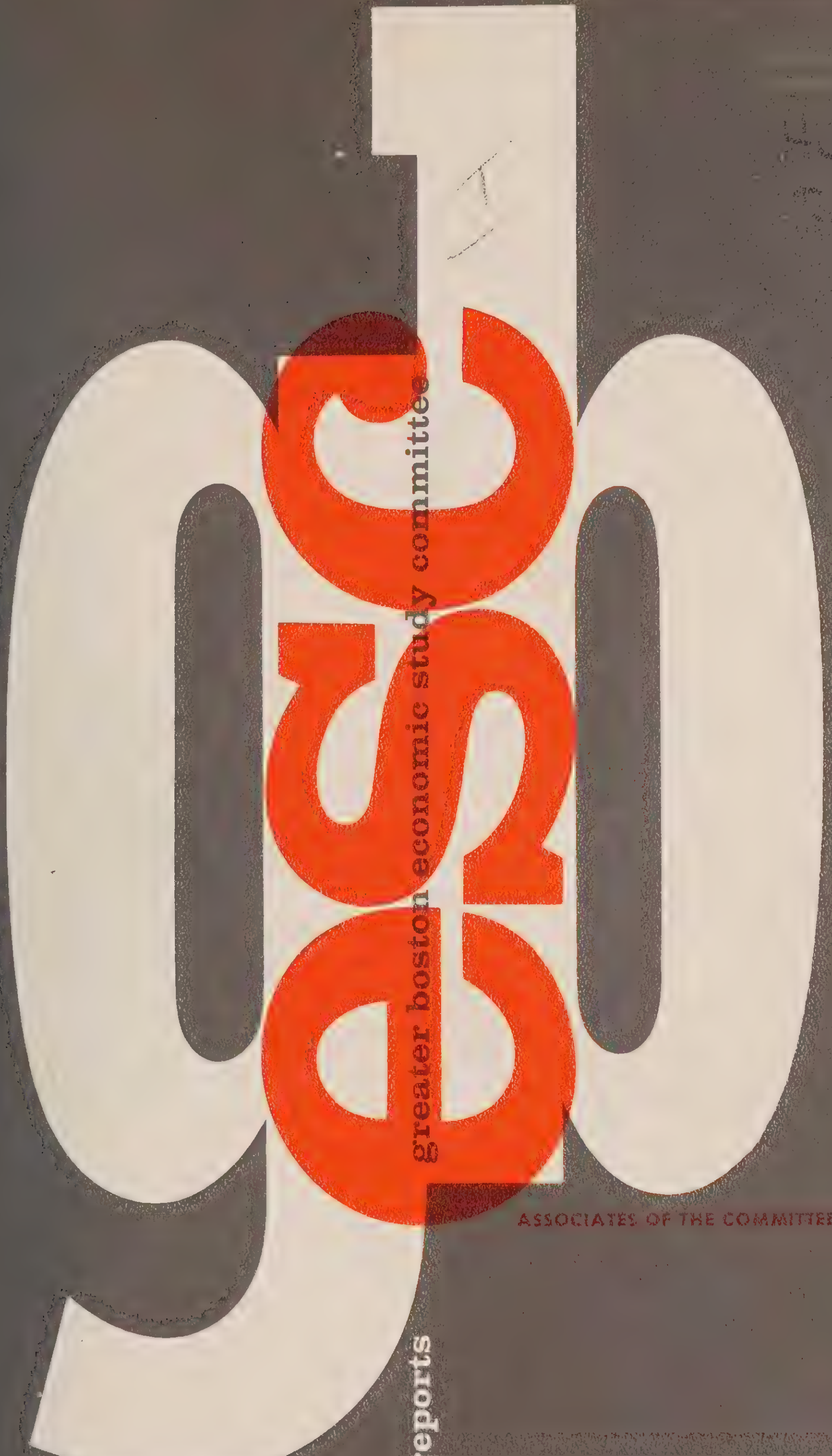

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GREATER BOSTON ECONOMIC STUDY COMMITTEE

The Greater Boston Economic Study Committee was organized in 1957. The Committee presently has eighteen members--fifteen are businessmen, one is a newspaper editor, and two are the deans of schools of business administration. To help guide the work of the Committee, a Research Advisory Committee was appointed. This group consists of leading scholars and experts in metropolitan affairs. In 1959, the GBESC became Associates of the Committee for Economic Development. The GBESC feels that this association has helped to broaden its own metropolitan program and organization.

The GBESC has two objectives. One is to gather, organize and circulate basic economic data which will advance an understanding of the forces and trends operating in the metropolitan area. The other is to formulate policy recommendations which may both stimulate and advise leaders in metropolitan affairs.

This base report is the work of several members of the GBESC staff. But a special word of recognition belongs to Mr. Julius S. Levine, a Research Associate of GBESC. The survey and other data on which this report are based were developed as part of his master's thesis in City and Regional Planning at the Massachusetts Institute of Technology.

The GBESC also acknowledges the interest and cooperation of the management of the Metropolitan Transit Authority.

economic base report 7

a survey of commuters on the highland branch

august, 1960

greater boston economic study committee

SSOCIATES OF THE COMMITTEE FOR ECONOMIC DEVELOPMENT 200 BERKELEY STREET, BOSTON 17, MASSACHUSETTS, LIBERTY 2-2146

INTRODUCTION

In June, 1958, the Greater Boston Economic Study Committee published COMMUTING: A POLICY STATEMENT. The central conclusion of the report was that the plan of rapid transit extensions recommended by the Metropolitan Transit Recess (the Coolidge) Commission of 1947 should be implemented.

When COMMUTING was issued, no suburban MTA extensions had been completed, though the recommended Highland Branch had reached the planning stage. GBESC support for extensions was based on a critical review of the recommendations of the Coolidge Commission and the conviction that an integrated metropolitan transportation system must include rapid transit connections between the growing suburbs and downtown Boston.

The Highland Branch was opened in July, 1959, and now that a

year has passed, an operating transit extension can be examined. This report--a partial evaluation of the extension--is based on a survey of Highland Branch rider habits and attitudes, supplemented by data on traffic flows in the corridor to the west of Boston.

The Committee plans to issue a second policy statement on commuting in which the evaluation will be completed. The Committee will address itself to the financial aspects of the Highland Branch and to the broader economic problem of financing expanded rapid transit in the Boston Metropolitan Area. The material presented here was developed as necessary background for these projected analyses.

The purpose of this survey of the Highland Branch was to find answers to two important questions:

1) What ridership, travel patterns, and attitudes has the Highland Branch generated?

2) What effect has the extension had on congestion and parking

problems in the central business district and on congestion in the traffic arteries leading into Boston from the west?

THE HIGHLAND BRANCH SURVEY

As shown in Figure I, the Highland Branch extends for a distance of about 12 miles from downtown Boston to its Newton terminus at Riverside near Route 128. During the morning rush it takes 35 or 40 minutes to make this run. The MTA estimates that 26,000 persons ride the line daily. Although the Highland Branch actually begins at Fenway Park, this survey is concerned mainly with ridership generated at the westerly eight stations--Reservoir through Riverside. Only the area served by these stations adds to the territory receiving effective MTA rapid transit service.[1]

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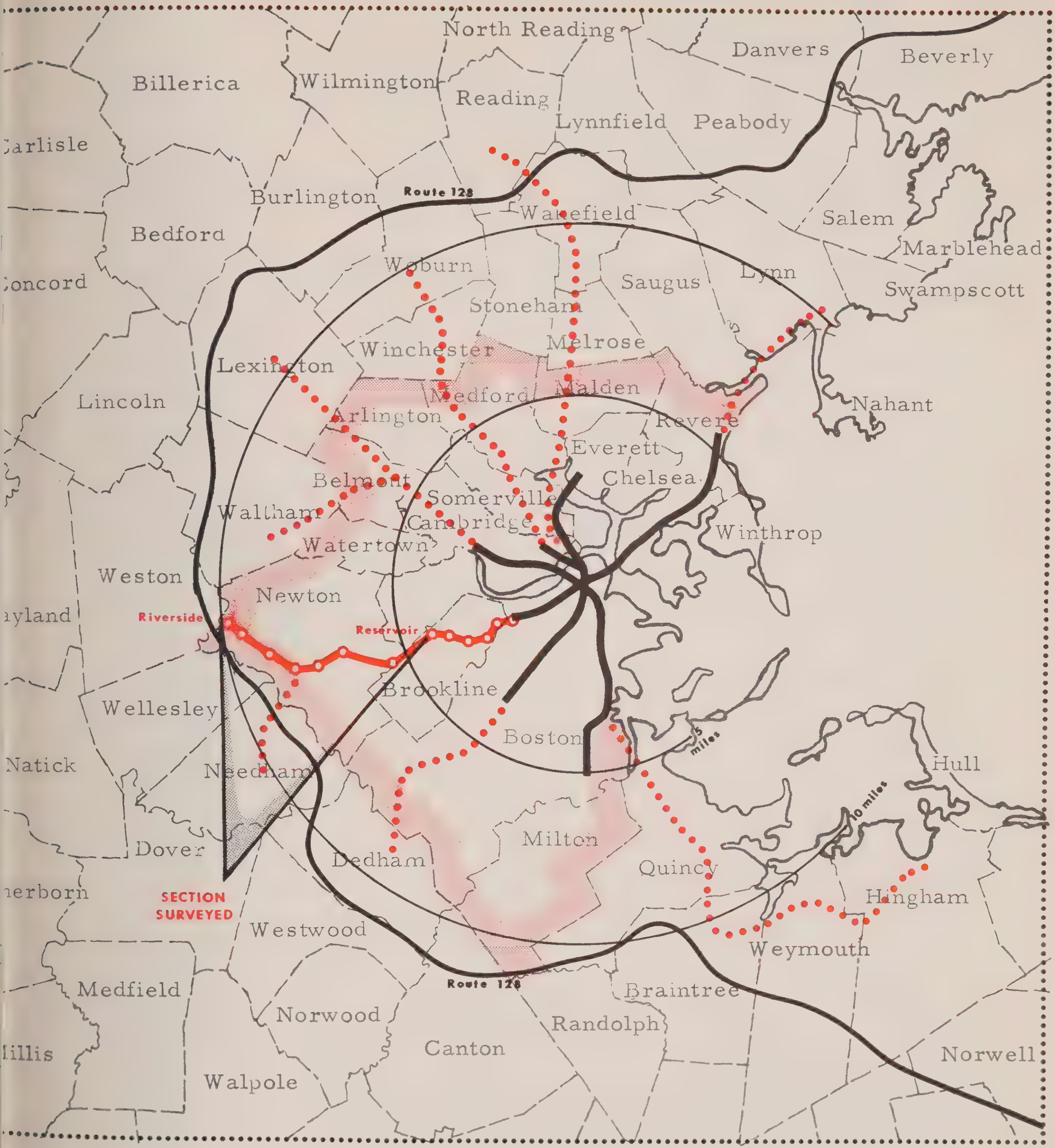
[1] Rapid transit refers to rail service which makes relatively few stops and runs over a separate right-of-way. In this report, it is distinguished from other forms of mass transit, such as buses and other rail service, which must contend with street traffic and grade crossings. Rapid transit is distinguished from the commuter railroad by frequency of service and relatively low fares.

THE MTA RAPID TRANSIT SYSTEM: figure 1



▨ MTA DISTRICT

▬ EXISTING RAPID TRANSIT LINES

▬ HIGHLAND BRANCH EXTENSION, ○ STATIONS

••••••• PROPOSED BRANCH EXTENSIONS

On March 16, 1960, a clear, cold Wednesday, inbound passengers boarding the study segment of the Highland Branch between 7 a.m. and 6 p.m. received a GBESC survey questionnaire. In all, 6,000 questionnaires were distributed, and within one week over 2,100, more than one-third, were returned. This rate of return, high by any standard, is especially significant because of the length of the questionnaire and the fact that it had to be returned by mail. It can be assumed that this rate of return reflects a high level of public concern about the MTA in general and the Highland Branch in particular.

SUMMARY OF FINDINGS

A detailed analysis of the responses to the Highland Branch rider survey is presented below. In summary, the main findings are these:

1) The Highland Branch has made it easier for all residents in suburban cities to the west to reach downtown Boston.

2) In addition to providing a new commuter service, the Highland

Branch frees the equivalent of one traffic lane in the highway system during the peak hours.

3) A large proportion of Highland Branch riders have become habitual users of the line. Seventy-five per cent of all respondents said they almost always use the Branch for trips into downtown Boston.

4) Over one half of the 26,000 daily passenger trips taken on the Branch either originate or terminate in the suburban areas which were not previously served by rapid transit.

5) Roughly 40 per cent of all commuters who board at stations west of Reservoir live in municipalities outside the present MTA district.

6) The Highland Branch alleviates peak period traffic congestion in downtown Boston by about 7 per cent, and it frees about 1,300 downtown parking spaces for other use.

7) The MTA's Highland Branch ridership is ten times greater than that of the railroad commuter service it replaced.

8) Half the riders report they use the Branch because of the specific advantages it has over the automobile and the commuter railroad. These are economy and freedom from parking problems and traffic congestion.

9) Infrequent riders of the line report they were deterred mainly by uncomfortable riding conditions, such as crowding, swaying cars, noise, and cold.

10) Infrequent riders use private automobiles as the main alternative to the Highland Branch, particularly during off-peak periods. During the peak period, however, the Boston and Albany commuter train is also often used by the infrequent rider.

OTHER IMPLICATIONS OF THE HIGHLAND BRANCH OPERATION

The Highland Branch experience has implications which transcent the findings reported here, but their importance cannot be assessed on the basis of one year's operations. As this report goes to press, equipment and operating innovations aimed at reducing running times on the line are being suggested by the new management of the MTA system. But apart from the effects of these possible changes, only the passage of time will show:

1) how the regional land use pattern is altered by a rapid transit extension;

2) whether mass transit can generate ridership in areas of great population growth but relatively low population density, and finally:

3) how the cost of serving outlying municipalities by mass transit compares with the cost of building more expressways and streets.

Beyond even these important issues, however, the Highland Branch experience draws attention to a basic policy choice which must soon be made by the Boston metropolitan community. The choice is between development influenced by a transportation network which includes more rapid transit extensions, or growth unaffected by them. It is significant that several major metropolitan areas which have grown up without mass transit are now planning for such systems despite the financial difficulty which mass transit encounters almost everywhere. The lesson of this is that the success or failure of mass transit cannot be measured by dollar costs alone.

The Committee re-emphasizes here that this study was only a study of ridership and does not include a review of the financial operations of the Highland Branch. When the necessary data are available, such a financial analysis will be made, and in addition, the GBESC will then consider the economic and financial aspects of expanded rapid transit in the Boston Metropolitan Area.

ANALYSIS OF RESPONSES TO THE QUESTIONNAIRE

The questionnaire used in the Highland Branch survey was divided into three sections. Part I sought information about the trip being made when the questionnaire was received. Part II requested data on other kinds of trips which the respondent makes on the Branch. Part III was designed to develop socio-economic and other information which would help in the interpretation of rider habits and attitudes. The analysis of survey results follows the organization of the questionnaire.

An analysis of the impact of the Highland Branch on traffic congestion and parking problems is also presented below.

PART I -- THE TRIP BEING TAKEN WHEN THE QUESTIONNAIRE WAS RECEIVED

The travel pattern generated by the Highland Branch is similar to the pattern for the MTA system as a whole. At the eight stations

PART I — The trip being taken when the questionnaire was received.

1. What time of day did you receive this questionnaire?

	% Distribution of 2168 Respondents
between 7 a.m. and 9 a.m.	65
between 9 a.m. and 4 p.m.	30
between 4 p.m. and 6 p.m.	5
	100

2. What was the purpose of the trip?

	% Distribution of 2219 Respondents
work	63
social or entertainment	6
personal business	6
shopping	9
school	13
other	3
	100

3. Where were you going on this trip?

	% Distribution of 2163 Respondents
downtown Boston	77
elsewhere	23
	100

4. Counting all means of travel (MTA, car, taxi, etc.) how often do you go to this destination?

	% Distribution of 2134 Respondents
daily	69
2 or 3 times a week	10
less than 2 or 3 times a week	21
	100

5. How often is the Highland Branch your means of travel to this particular destination?

	% Distribution of 2154 Respondents
almost always	74
about half of my trips	11
about one quarter of my trips	6
rarely	6
this is the first time	3
	100

6. If you do not always use the Highland Branch, what is your most frequent alternative means of travel?

	% Distribution of 295 Respondents
car	58
car pool	5
car and MTA other than Highland Branch	10
Boston and Albany main line	17
Boston and Worcester bus	3
Middlesex and Boston bus with MTA other than Highland Branch	1
MTA other than the Highland Branch	4
other	2
	100

surveyed, two thirds of the inbound passengers board trains between 7 and 9 a.m. During this period, 80 per cent are enroute to work, and another 15 per cent are enroute to schools and universities. In contrast, over half of all trips made between 9 a.m. and 6 p.m. are for shopping, personal business, and social or entertainment purposes.

Three out of every four riders report their destination is downtown Boston. The same proportion of the riders say they "almost always" use the Highland Branch for trips of the kind they were making when they received the questionnaire. Just over 50 per cent of all persons make a daily inbound trip, and in addition, almost always use the Branch for this trip.

Three hundred respondents reported their alternative means of travel when they do not use the Highland Branch for the trip they were describing in Part I. Just over two-thirds drive automobiles,

and 17 per cent use the Boston and Albany commuter railroad. Relatively few use other MTA lines as commuting alternatives.

PART II -- TRIPS DIFFERENT FROM THE ONE BEING TAKEN WHEN THE QUESTIONNAIRE WAS RECEIVED

The object of Part II was made to measure the supplementary travel needs and habits of Highland Branch riders by asking them to report on trips made for purposes different from the one reported in Part I. To illustrate, if a respondent reported a work trip when he received the questionnaire, Part II asked him to report on trips other than work trips. In this report, the term "other trips" is used to describe the responses in Part II.

Most "other trips" are made at off-peak hours, and analyzing them provides insights into the nature and volume of off-peak travel. Some respondents cited more than one reason, and in all, over 2,200 reasons were tabulated. The distribution of reasons cited shows that

PART II — Trips different from the one being taken when the questionnaire was received.

7. Counting all means of travel, how often do you make inbound trips for a reason other than the one you described in Part I?

	% Distribution of 1889 Respondents
daily	7
2 or 3 times a week	12
less than 2 or 3 times a week	81
	100

8. What is the most common reason for these trips?

Note: Some respondents gave more than one reason without indicating which one was the most common. All citations were therefore used in making this tabulation.

	% Distribution of 2236 Reasons Given
work	12
social or entertainment	39
personal business	15
shopping	28
school	3
other	3
	100

9. How often do you use the Highland Branch for these trips?

	% Distribution of 1889 Respondents
almost always	44
about half of my trips	13
about one quarter of my trips	9
rarely	34
	100

10. If you do not always use the Highland Branch, what is your most frequent alternative means of travel?

	% Distribution of 793 Respondents
car	81
car pool	1
car and MTA other than Highland Branch	5
Boston and Albany main line	4
Boston and Worcester bus	3
Middlesex and Boston bus with MTA other than Highland Branch	1
MTA other than the Highland Branch	4
other	1
	100

40 per cent of all off-peak travel is for social and entertainment purposes, 30 per cent for shopping, and 15 per cent is for personal business. Before 9 a.m., journeys to work rank first and account for almost two thirds of all trips. Work trips during the off-peak period rank fourth at 12 per cent.

The most important finding of Part II is, however, that while 45 per cent of all riders "almost always" use the Branch in the off-peak period, *35 per cent rarely use it*. Thus between commuting hours when riding mass transit is most comfortable, a large proportion of commuters prefer other means of travel. The main traffic arteries are also uncrowded at this time, and rapid transit is at a greater comparative disadvantage than it is in the morning. This characteristic of metropolitan transportation networks explains why efforts to increase off-peak transit ridership have not achieved outstanding success.

PART III -- GENERAL INFORMATION RELATING TO THE USE OF THE HIGHLAND BRANCH

The purpose of Part III was to develop other relevant information about riding habits on the Highland Branch and some socio-economic data on suburban commuters.

Employment and Occupation

Riders were asked to report their industrial and occupational classification according to selected categories borrowed from standard government classification systems. Of the 1,500 persons who reported their industrial classification, 20 per cent are in financial and related industries; 13 per cent, in education; 8 per cent, in retail trade; and 7 per cent, in manufacturing. The remainder are employed in government, construction, utilities, transportation, wholesale trade, and business services.

Over 1,800 respondents report their occupations as follows: 30 per cent scientific, technical, or professiona; 20 per cent

PART III — General information relating to the use of the Highland Branch.

11. Where is your home?

	% Distribution of 2118 Respondents
Newton	50
Wellesley	12
Brookline or Boston	11
Needham	6
Natick	5
Framingham	4
Weston	3
Waltham	2
Wayland	2
22 other towns	5
	100

12. How do you usually get to your MTA station?

	% Distribution of 2287 Respondents
walk	34
drive and park car	34
dropped off	19
bus	10
other	3
	100

13. How long does it usually take you to get from your home to the MTA station?

	% Distribution of 2075 Respondents
5 minutes	36
10 minutes	31
15 minutes	16
20 minutes	8
25 minutes	3
30 minutes	3
more than 30 minutes	3
	100

14. Check the most important means of transportation you used prior to the opening of the Highland Branch.

	% Distribution of 1084 Respondents
car	35
car pool	2
car and MTA other than Highland Branch	13
Boston & Albany main line	25
Boston & Worcester bus	10
Middlesex and Boston bus with MTA other than Highland Branch	7
MTA other than the Highland Branch	4
other	4
	100

15. What is your main reason for using the Highland Branch?

	% Distribution of 1448 Respondents
goes directly to my destination	16
fastest to my destination	13
convenient to my home	11
MTA is cheaper than other means of transportation	19
service is frequent	11
convenient in combination with my car	8
avoids parking problems	11
avoids traffic congestion	9
other	2
	100

16. How long does it generally take you to go from your home to your most frequent destination in downtown Boston?

Note: 1902 respondents from the towns shown below indicated time required on the Highland Branch. 1508 indicated time on the best alternative means.

	Average Minutes on Highland Branch	Average Minutes on best Alternative
Newton	37	40
Brookline and Boston	30	35
Wellesley	49	47
Weston	47	44
Needham	45	44
Natick	57	52
Wayland	51	45
Framingham	58	54

17. If you are only an occasional rider on the Highland Branch, state your most important reason for not using it more frequently.

	% Distribution of 296 Respondents
overcrowding and related	25
other physical discomforts	7
too slow and related	13
inadequate parking facilities and parking costs	4
return service inadequate	9
inconvenient to home and/or destination	18
less flexible than car, car required throughout day and related	22
other reasons	2
	100

18. How many cars are there in your household?

	% Distribution of 2129 Respondents
None	9
One	55
Two	31
More than two	5
	100

19. What is the total income of the household in which you live?

	% Distribution of 1902 Respondents
under $3,000	4
$3,000 to $5,000	9
$5,000 to $7,000	17
$7,000 to $10,000	25
$10,000 to $15,000	24
$15,000 to $20,000	10
over $20,000	11
	100

20. Use both classification systems shown below to describe your industry and occupation.

	% Distribution of 1467 respondents reporting industrial classification
Construction	3
Manufacturing	7
Trucking and Transportation	1
Utilities	3
Wholesale trade	4
Retail trade	8
Finance, insurance, real estate	19
Business services	2
Personal services	5
Entertainment and recreation	1
Medical	5
Educational	13
Other professional	11
Government (non-Military)	5
Other	13
	100

	% Distribution of 1820 respondents reporting occupational classification
Professional, technical, scientific, etc.	29
Management, official	19
Sales worker	5
Clerical worker	6
Secretarial worker	8
Craftsman, foreman	1
Operative (machine, etc.)	1
Household worker	1
Service worker, except household	1
Housewife	11
Student	6
Other	12
	100

management; and 11 per cent housewives. The remainder are craftsmen, laborers, domestics, sales personnel, clerical workers, and students.

Place of Residence and Income

About 40 per cent of all riders who board the Highland Branch between Reservoir and Riverside live in towns outside the present MTA district. Another 50 per cent live in Newton.

Data on household incomes in the cities and towns of the Boston Metropolitan Area are not available, and the household incomes in the service area of the Highland Branch cannot be compared with incomes in the area as a whole. However, it is reasonable to assume that household incomes in the service area of the Branch are relatively high within the Boston region. Over 70 per cent of all respondents report household incomes in excess of $7,000 per year, and almost half indicate $10,000 or more.

Reasons for Riding the Highland Branch

Of 1,450 riders who gave reasons for preferring the Highland Branch, about 40 per cent say the line is the fastest and/or most convenient means of travel to their homes and/or destinations. Another 20 per cent cite economy, and 20 per cent more prefer freedom from traffic and parking problems. Ten per cent use it because it is "frequent", and 8 per cent report that the Highland Branch in combination with the automobile is the most convenient means of travel.

An important subgroup of 875 respondents reported both present reasons for using the Highland Branch and former means of travel. Thirty-eight per cent had used automobiles and 24 per cent had commuted on the Boston and Albany main line.

Of the former auto users, 70 per cent now prefer the Highland Branch for the characteristics which differentiate it from automobile travel. Thirty-five per cent enjoy its freedom from traffic congestion

and parking problems; 15 per cent find it convenient in combination with the automobile and 11 per cent cite economy. While speed is not necessarily an advantage of mass transit, 7 per cent actually find the Highland Branch faster than travel by car. The remaining 30 per cent of former auto users now use it for reasons which are not unique advantages of mass transit. Convenience to home and/or destination, and frequency of service are among them. The importance of this group lies in the fact that its members could use automobiles but do not. This suggests that a large group of riders can be attracted to mass transit if only it meets the convenience standards of competing travel alternatives.

As expected for riders who formerly used the commuter railroad, frequency and economy of service are the main advantages of the Highland Branch. These two reasons alone account for 50 per cent of all reasons given by former railroad commuters.

Reasons for Infrequent Use of the Highland Branch

Occasional riders on the Branch were asked to state reasons for not using it more often. Fifty per cent complain of physical conditions -- "crowding, too slow, noisy, swaying cars", etc. Ten per cent cite infrequency and other service characteristics such as inadequate return service. The remaining 40 per cent report the line is not as flexible as the automobile or that it is inconvenient to home and/or destination.

These complaints may be relevant to efforts aimed at increasing ridership, but they must be interpreted with caution because they reflect the attitudes only of persons who actually ride the line. A comprehensive survey of suburban attitudes to mass transit would be required to develop a reliable measure of the potential ridership.

Travel to Station and Commuting Time

Respondents also reported on the means used to get to their

station. Over one-half either drive and park automobiles or are "dropped off". One-third walk, and 10 per cent reach the Branch by bus. There are, however, some variations by station. Riverside and Woodland are dominated by automobile users, while stations further in, such as Newton Highlands or Newton Center, which serve a more densely populated area, have a greater proportion of persons who walk.

Time saved or lost by persons riding the Highland Branch is not great. On the average, residents of Wellesley, Weston, Needham, Natick, Wayland, and Framingham report they lose time by using the Highland Branch, but very few lose as much as five minutes. In contrast, residents of Newton, Brookline, and Boston report they gain time, but rarely is it more than five minutes.

Variation Among the Stations

Variations in ridership characteristics and patterns by station is slight. Riverside and Woodland, however, have a greater than

average proportion of riders who: 1) live outside the MTA district; 2) use automobiles to reach the station; and 3) make daily inbound trips. In addition, Woodland attracts a large number of housewives destined to downtown Boston for shopping purposes. The combination of superior road connections, ample parking facilities at the station, and bus connections make Woodland attractive to suburban housewives.

THE HIGHLAND BRANCH IMPACT ON TRAFFIC CONGESTION AND PARKING PROBLEMS

The Effect in Downtown Boston

Estimates based on Boston City Planning Board data indicate that before the Highland Branch was opened, 30,000 people from all parts of the metropolitan area traveled daily into downtown Boston by automobile between 7 and 9 a.m. On the basis of the commuting patterns reported in this survey, it is estimated that 1,200 persons who board the Riverside-Reservoir segment alone would use automobiles if they did not use the Branch to commute to downtown Boston. This means that

travel into downtown Boston is reduced by 4 per cent (1,200/30,000) during the morning peak period.

It is estimated that the entire Highland Branch, Fenway Park through Riverside, reduces peak period automobile passengers by 2,000, and that traffic congestion is therefore reduced in downtown Boston by almost 7 per cent (2,000/30,000).

When a conversion factor of 1.5 persons per car is applied to the estimated 2,000 former automobile users who now commute to downtown Boston on the Highland Branch, it is estimated that the number of automobiles going downtown is reduced by over 1,300 (2,000/1.5) during the peak period. As these cars would be used by persons who make a trip terminating downtown, it can be assumed that almost all of them would have to be parked in the city. There are approximately 26,000 parking spaces in downtown Boston. The Highland Branch therefore releases about 5 per cent (1,300/26,000) of the total available parking

space in downtown Boston for other uses.

The Effect on Congestion in the Newton Corridor

It is also possible to estimate the traffic reduction in the Newton corridor, that is, on the highway system between Riverside and Cleveland Circle. The estimate is a conservative one, as the available data permit only a consideration of the effect due to only the Riverside-Reservoir segment of the Branch.

In addition to the 1,200 peak period riders who have abandoned automobiles and board along this segment of the Branch, it is estimated that another 600 suburban commuters used to drive as far as Cleveland Circle but now park farther out. Using a conservative conversion factor of 1.5 persons per car, it is estimated that perk period automobile traffic in the Newton corridor is reduced by 1,200 cars (1,800/1.5). Translated into "released" traffic lanes, this reduction in automobiles means that the Highland Branch has freed the equivalent of at least

one traffic lane in the Newton corridor for automobile use during the peak travel hours.

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8

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GREATER BOSTON ECONOMIC STUDY COMMITTEE

The Greater Boston Economic Study Committee (GBESC) was organized in 1957. The Committee presently has eighteen members--fifteen are businessmen, one is a newspaper editor, and two are the deans of schools of business administration. To help guide the work of the Committee, a Research Advisory Committee was appointed. This group consists of leading scholars and experts in metropolitan affairs. In 1959 the GBESC became Associates of the Committee for Economic Development (CED). The GBESC feels that this association has helped to broaden its own metropolitan program and organization.

The GBESC has two objectives. One is the gathering, organization, and circulation of basic economic data which will advance an understanding of the forces and trends operating in the metropolitan area. The other is to formulate policy recommendations which may both stimulate and advise leaders in metropolitan affairs.

This report was prepared by the Metropolitan Planning Committee of the Wayland League of Women Voters. The authors alone are responsible for the content and conclusions of the report. The GBESC hopes that this and other economic base materials which it publishes will continue to serve the growing need for reliable information on the Boston metropolitan region.

gbesc

economic base report 8

wayland, massachusetts: a self study of a growing community

by the committee on metropolitan planning
wayland league of women voters

october 1960

greater boston economic study committee

ASSOCIATES OF THE COMMITTEE FOR ECONOMIC DEVELOPMENT 200 BERKELEY STREET, BOSTON 17, MASSACHUSETTS, LIBERTY 2-2146

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Members of the Wayland League of Women Voters contributed over 6,500 women-hours to ringing doorbells, tabulating, analyzing, writing, and typing this report. Special thanks go to Ruth Gerwig Jenkins who gave sustained experienced professional supervision to the statistical analysis of this study, and to my committee on Metropolitan Planning whose enterprise and devotion to this project under all kinds of pressure no chairman could forget or adequately reward.

Janet Dryer Page, Chairman
Committee on Metropolitan Planning
Wayland League of Women Voters

PREFACE

Since the Second World War, millions of Americans have been pursuing a new way of life. It has been found in the mushrooming suburbs which surround our great cities. Tired of life in the row housing and cliff dwellings that characterize congested cities, freed by the automobile from former dependence on subway and trolley transit, and attracted by low-interest mortgages, as well as the "status" attached to individual home ownership, the space-age American is finding his space in suburbia.

The suburb with its concentration of youth, energy, brains, leadership, and money provides the forces which are reshaping the way America lives and thinks. Shiny new schools, churches, and shopping centers have sprung up in the suburbs around the development-housed, development-conscious refugees from the city. But behind the external conformity, motorized lawn mowers and matriarchial management, is a serious, if sometimes provincial, dedication to municipal affairs that should both startle and stimulate the machine-driven politics of city and state.

This survey of Wayland, Massachusetts, illustrates the drama of municipal growth and municipal consciousness among the newer suburbs of Metropolitan Boston. It also illustrates a research technique open to many suburban towns when local talent and leadership join in a cooperative enterprise to assess their town's position in and relation to the "exploding metropolis."

Like any community survey, this one does not answer all the questions which can be raised about the suburbs or the metropolis. However, its contribution to an understanding of metropolitan economic problems having to do with patterns of commuting, shopping, recreation and population mobility represent a pioneer job which helps to quantify the many speculative studies of suburbia which have been made.

It is significant that the typical questions raised by most metropolitan planners was omitted by the authors of this report. The Wayland League of Women Voters' Committee on Metropolitan Planning

and other town leaders who worked on it decided against asking a direct question about metropolitan planning because it was felt the whole subject was too little understood or too misunderstood to have reliable meaning for statistical analysis. Yet the entire survey strikes at the heart of some of Greater Boston's most basic metropolitan planning issues. For example, the survey reports that 61 per cent of the citizens are willing to see municipal funds invested annually in the preservation of green space for recreation and wild life which will conserve the country atmosphere of the town. The ability of Greater Boston residents to reach the green suburbs has always been a major advantage and attraction of the Boston Metropolitan Area. But the suburbanization of industry and the expansion of our expressway construction has already caused and threatens to continue serious erosion of this great economic asset.

Like their neighbors in most of the newer suburbs, Wayland's people are highly auto-oriented. The extremely limited mass transportation facilities which are available will not serve the needs of Wayland residents who commute to other cities and towns of the Greater Boston area for purposes of breadwinning, bread-buying, and the purchase of professional services. Ninety-seven per cent of Wayland families therefore have automobiles. Forty-nine per cent have two or more. Every day 86 per cent of Wayland's households send at least 2,000 commuters to 72 different cities and towns. This contribution of traffic helps aggravate an already serious metropolitan traffic problem which no community can solve by itself.

There is much speculation by city planners, developers, and businessmen on the relative strength of a back-to-the-city movement in metropolitan Boston. Yet the 1960 census has shown that Boston alone lost over 100,000 people in the last ten years. Guesses about where these people have gone, whether they will continue to go, return, or move farther out, cannot be made usefully in a milieu of changes whose nature is not understood.

This study of Wayland, Massachusetts, is an example of a first step toward minimizing the guesswork. The fact that it could happen in a town which has inherited governmental machinery designed to reflect the grass roots sentiment of the rural New England community demonstrates that even 18th century institutions can be maintained in a viable state by an alert and dynamic citizenry.

Gregory B. Wolfe
Director of Research
Greater Boston Economic Study Committee

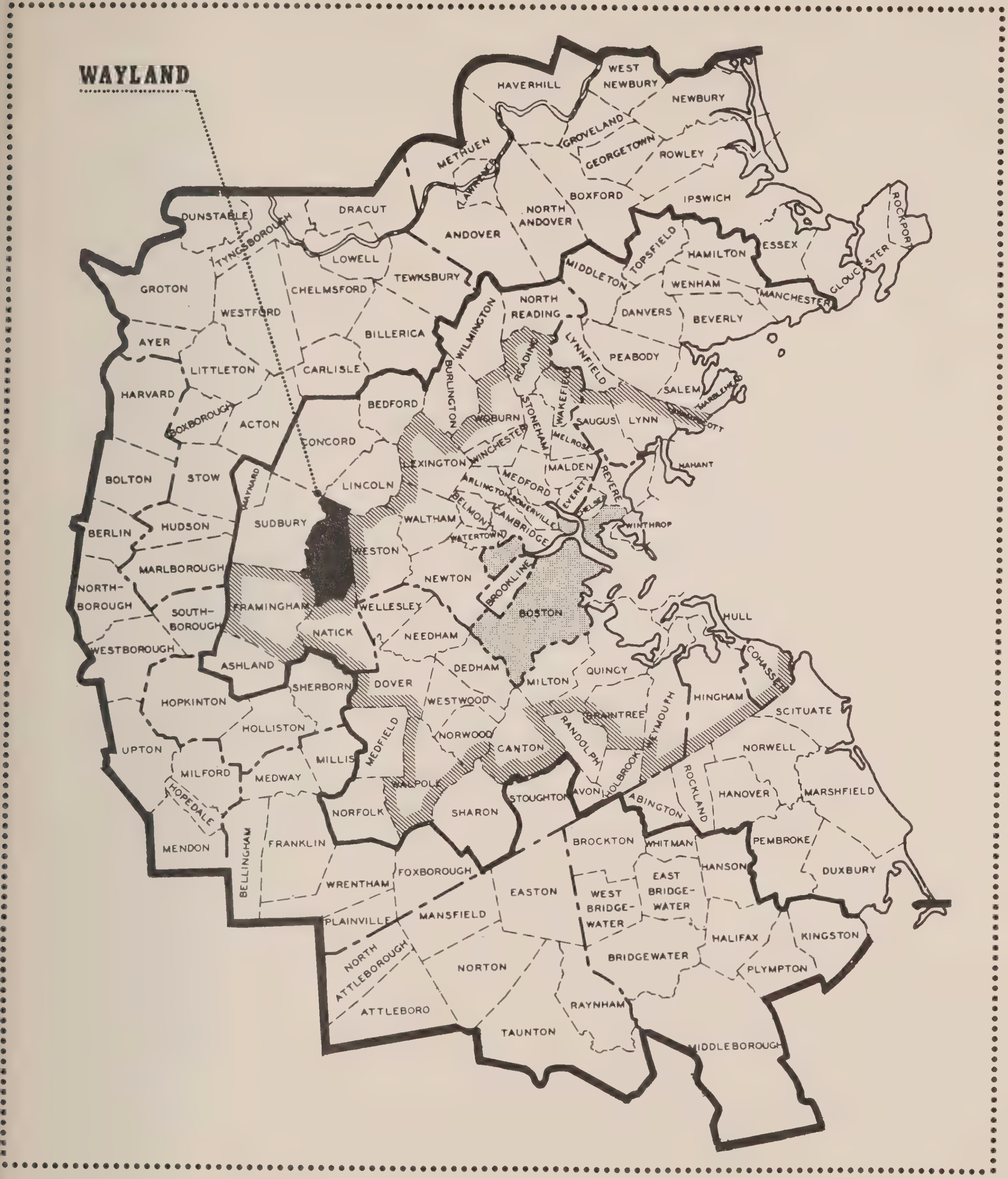
WAYLAND, MASSACHUSETTS:
A SELF STUDY OF A GROWING COMMUNITY

Introduction

In October, 1958, the League of Women Voters of Wayland began a study of regional planning as related to Wayland's needs and obligations in a growing metropolitan area. This study first focused on certain local problems in a regional context. Included were public and private transportation, fire and police protection, health services and utilities, and legislation governing cooperation among communities. League members were impressed by numerous examples of the interdependence of communities in the Boston area; yet they learned that Boston is one of the large metropolitan areas in the United States still lacking comprehensive planning.

The principal fact became clear that Wayland, like many historically autonomous political units in the New England area, was in the path of an economic revolution, the degree and direction of which had not been gauged. Certain primary questions began to emerge. Where is the sharply increasing population coming from? What are

LOCATION MAP: FIGURE 1



▭ **City of Boston**

▨ **MDC District Boundary**

— **Boston Standard Metropolitan Area, U S Census 1960**

━ **GBESC Study Area**

the major factors contributing to the town's growth? Do the new residents come from nearby or do they represent broader demographic patterns? Where do the residents of Wayland go to work and what types of transportation do they use? An understanding of the interdependence of Wayland with its surrounding towns seemed to evolve from such questions as where its residents shop, seek recreation, and find professional services. Encompassing all these questions was the larger question which goes to the heart of regional planning: To what extent is a fringe suburb tied to its metropolitan area? And what influence does the core city of Boston have upon Wayland?

In October, 1959, 200 members of Wayland's League of Women Voters set out to ring all local doorbells. They carried a questionnaire prepared by local League members designed to find answers to the above questions and to gather some other data of particular interest to the town's planning board. As a public service, they also took the state-required school census. An explanatory letter to all households from the Town Planning Board preceded the calling.

Response of the townspeople to the survey was excellent. The data in this report is based on information from 2,211 households, representing 8,769 persons. This is 86 per cent of the town's estimated population. Collation, population analysis, and drafting

of the report was done entirely by the League of Women Voters and consumed over 6,500 woman-hours.

A. Biography of Wayland

Local government in New England has developed primarily in the town rather than in the county or township as in other regions of the United States. As a result, town boundaries have, with the passage of time, become stronger rather than weaker lines of separation. Once established, towns have not federated into large units despite the pressures of metropolitan growth. As a rule, they have neither been annexed nor been able to annex adjoining territory. Nevertheless, the nature of old New England towns in Greater Boston is being radically changed. This change, however, has come not as the result of increases in physical size but as a consequence of the pressures created by the influx of new citizens seeking country living.

Wayland, Massachusetts, is such a town. It is located 17 miles west of Boston. As the town grew, two centers of population and activity developed. The northern center is on U.S. Route 20, the old Boston Post Road which has served since before the Revolutionary War as a main east-west highway of the state. The southern center, locally called Cochituate after the town's largest lake, has its own Post Office and telephone exchange. The eastern extension of Boston's Commonwealth Avenue is its main link to the rest of the

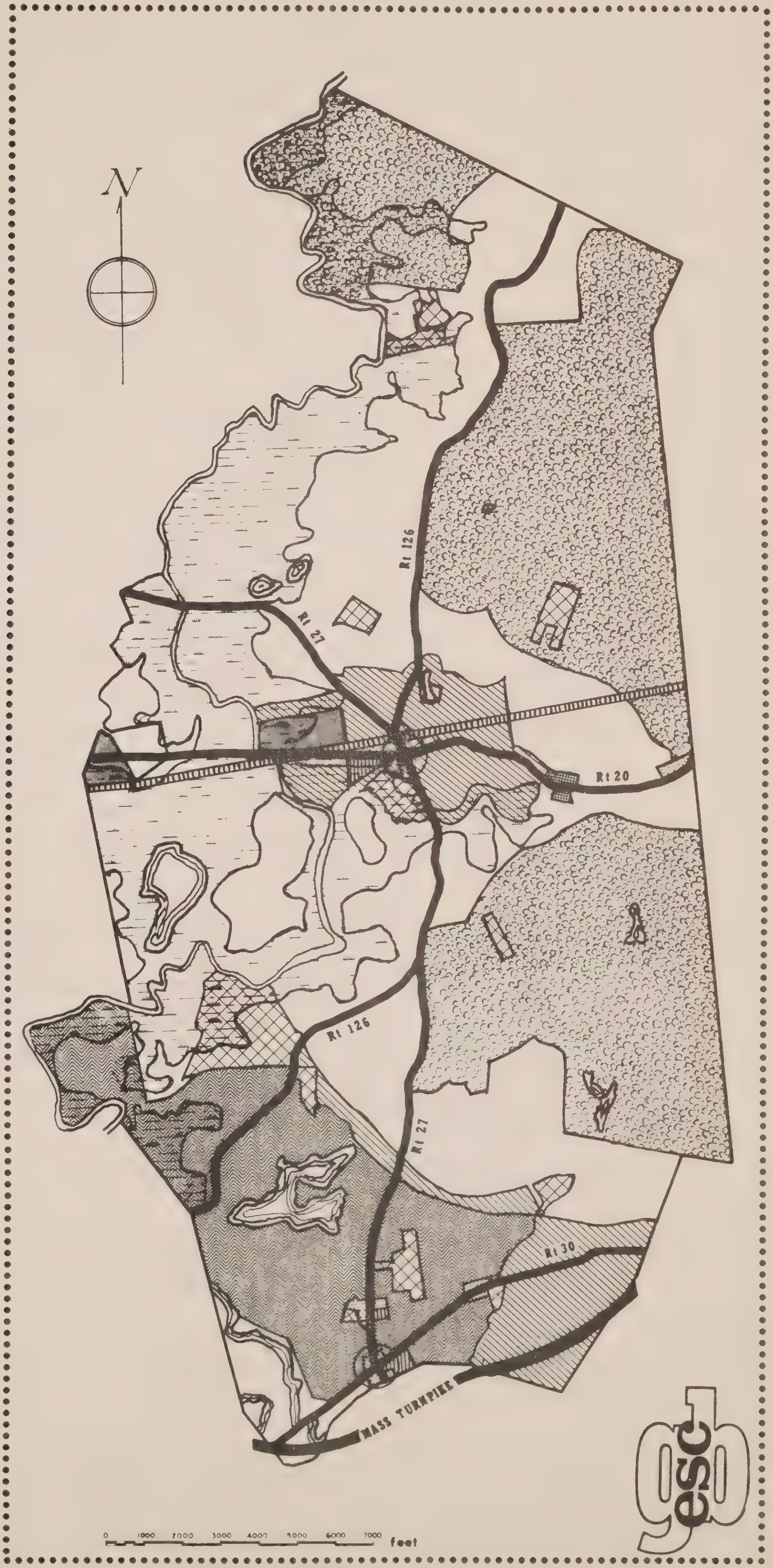
metropolitan area.

First settled in the 17th Century, Wayland was originally a farming community. During the 19th Century a shoe manufacturing industry developed in the southern part of town, but all vestiges of this have disappeared as have most of the farms.

In the early part of this century, the lakes and ponds which dot the town attracted a summer population who built small cottages on small plots of land, there being no zoning laws prior to 1934. The Sudbury River, an old meandering stream whose flood plain is noted as one of the main stopping places for migratory birds in the New England fly-way, passes through the town. There are now two small shopping centers, several churches, various women's, fraternal, and social organizations and two public golf courses but no other commercial recreational facilities. Wayland's public school system has recently received national recognition.

Though a large electronics company has located a research laboratory in the town, Wayland is primarily a residential community. There are few multiple dwellings, but there is a wide range in size and value of single residences. Zoning laws passed in 1953 restrict lot sizes from a minimum of 20,000 square feet in some sections up to 60,000 square feet in others. Thus zoning ordinances, to a large extent, control population growth and land use. (Figure 2)

ZONING MAP - TOWN OF WAYLAND FIGURE 2



LEGEND •

▨	**Residence**	20,000 Sq Ft 120' Frontage
▨	**Residence**	30,000 Sq Ft 150' Frontage
☐	**Residence**	40,000 Sq Ft 180' Frontage
▨	**Residence**	60,000 Sq Ft 210' Frontage
▨	**Business A**	
▥	**Business B**	
▨	**Limited Commercial**	
▦	**Roadside Business**	
☐	**Flood Plain**	
▩	**Town Property**	
○	**Shopping Centers**	

Here then is a typical old New England town which for the first time in 1960 found itself included in the U.S. Census as part of Metropolitan Boston. Like many places, Wayland is beginning to reconsider its insularity and look closely, if defensively, at its metropolitan environment.

B. Population

Wayland, Massachusetts, was settled in 1638, less than two decades after the Pilgrims landed at Plymouth, and was established five years after the Revolutionary War as a politically independent town. By the year 1800, 832 people were living in the town. For a century and a quarter Wayland experienced slow but steady growth, and in 1925 the population stood at about 2,200. During the same 125 years, the population of Greater Boston had increased almost 15 times in contrast to Wayland's which had less than trebled. This reflected the fact that most of the people were concentrated in the inlying cities and towns where the population had increased 40 times over.

The coming of the automobile and improved roads in the 1920's put Wayland within reach of people hungry for a home set among wooded hills, water, and open land rather than in the clutter and congestion of the city. Thus the process of colonization of Wayland by former city dwellers began and continued through the Depression and the Second World War. But the full effect of the new migration was

not felt until after the War. From 1950 to 1960 Wayland more than doubled its population as it grew from 4,400 to 10,200. In a single decade, Wayland gained one and a half times as many people as it had in the preceding one hundred and fifty years.

Rapid growth of population is not peculiar to Wayland; many of the towns surrounding Boston seem to be threatened with inundation by new arrivals. As these hinterlands have become suburban, burgeoning population superimposed on existing social and administrative structure has caused a series of problems which have become, in ten short years, as much a part of the suburban tradition as the backyard cookout. The problems brought on by population growth--the erosion of green space, growing traffic congestion, and increasing property taxes--face all suburbs. For this reason, a study of Wayland is, to a considerable degree, a case study of many of the "new" suburbs of the Greater Boston area.

C. Character of the Growth

Of every ten adults in Wayland, nine migrated there, and seven have come to the town within the last ten years. Less than 1 per cent of all adults were born and reared locally. The extremely rapid growth of Wayland--high even among the suburbs of Boston--reflects the migration of people out of the inlying cities and towns, as 40 per cent of Wayland's adults grew up somewhere in MDC Boston.[1]

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[1] See Figure 1.

The remaining 60 per cent is divided about equally between persons who grew up elsewhere in New England and elsewhere in the rest of the United States, this latter group coming mainly from the Eastern Seaboard between New York and Washington, D. C. Though migrants from foreign lands were few in number, it is interesting to note that 37 foreign countries are represented in Wayland's population.

Wayland follows the suburban characteristic of being well above average in household size for the Boston area as a whole. On the average there are 3.96 persons per household with the result that adults account for just over one half of Wayland's total population. This average figure, however masks a considerable variation in family size. There are, for example, as many families in Wayland with no children as there are with three or more. The high proportion of young people--almost half--is important because of its special significance for education costs which account for one half of the town's total budget.

D. Attitudes Toward the Town : Reasons for Growth

The appeal of country living ranked first among reasons for settling in Wayland. (See Table 1) The mention of such associated factors as large lots, small town or suburban living, and nearness to water emphasized the compelling qualities of nonurban residence. Next to "country living," the most frequently mentioned reasons for

moving to Wayland were nearness to work and suitable housing. Thus the major reasons for moving to Wayland were the same ones which would probably be given by those moving to any suburb.

Table 1 - Reasons for Coming to Wayland

	Percent of all Adults Who Grew up in				
Reason	MDC Boston and elsewhere (4000 adults)	=	MDC Boston (1788 adults)	+	Outside MDC Boston (2212 adults)
Within commuting distance of work	28		17		37
Suitable housing	20		21		20
Lot/land spacious, attractive	7		9		6
Country living/to leave city	29		33		25
Suburban/small town	3		3		2
Summered in town/near water	3		3		2
Like town, area, people	12		13		12
Schools	4		3		4
Zoning, town gov't, taxes	1		2		2
Near Boston	2		1		2
Near transportation/other places	3		2		3
Marriage/influence family, friends	8		9		8
Other personal reasons or uncertain	1		1		1
No reason	2		3		1

Note: The columns do not sum to 100 per cent because about 75 per cent of all adults gave more than one answer. Excluded from the table are 390 households that did not move into the area and 264 households which gave no answer to the question.

E. Attitudes Toward the Metropolis : The Magnetic Field

Just over 40 per cent of those answering stated that Wayland's nearness to Boston was a factor in the decision to locate in Wayland,

(See Table 2). Among those who said they were not influenced by proximity to Boston, over half said nearness to employment influenced their decision. Many of these jobs are within MDC Boston or exist because of the core city of Boston.

Table 2 - Did the prospect of living near Boston influence your decision to live in Wayland?

Note: Two hundred sixty-three households in which one or more members grew up in Wayland are excluded from the table.

	Total Households	
Answer	Number	Percent
Yes	780	42
No	1059*	58
Total	1839	100
No answer	109	--

*Included are 109 households having commuters to Boston.

Tabulation of Reasons Given by persons who answered "yes."

	Number Citing Reason (multiple responses included)
Positive influence	
Business	438
Recreation/entertainment	41
Education/culture	79
Family/friends/home	48
Like Boston/city advantages	58
Medical services	8
Good routes/transportation	90
Shopping	32
Total answers	794
Total households answering	688
Negative influence/no answer	92

Table 2 - Did the prospect of living near Boston influence your decision to live in Wayland? (Continued)

Tabulation of Reasons for Living in Wayland Given by Persons Who Answered " no. "

	Number Citing Reason (multiple responses included)
Nearness to	
Business	479
Shopping/schools/churches/services	19
Family/friends/home	82
Another town	43
Suitable housing/lot	26
Good routes/convenient location	32
Country living/water	109
Liked town/area	26
'Nearness" not a factor	42
Total answers	858
Total households answering	803
No answer	256

F. Attitudes Toward the Town : Will They Stay?

There is a high level of satisfaction with the town among Wayland residents. (See Table 3) When asked where they would try to find another residence if they had to leave their present one, nearly half of those responding said they would try to relocate in Wayland. Two-thirds said that they would try to relocate in Wayland or in one of the surrounding communities. One out of six did not answer, many considering themselves so permanent it was impossible to answer.

One adult in five now living in town has lived elsewhere in Wayland

bearing out the fact that many do stay in town when they find a move desirable or expedient.

On the question of where they would try to relocate if they had to leave the town of Wayland, over one third of those responding indicated a preference for one of the surrounding towns. Only one out of ten of this group felt he would look for accommodation nearer the central city of Boston. This gives a strong implication that the back-to-the-city movement in Wayland is as yet negligible indeed.

Table 3 - Where would you go if you had to leave:

	Percent Distribution of Persons Indicating Where They Would Move if They Left	
	Their Present Home	Town of Wayland
Wayland	48	-
Surrounding towns	19	34
Nearer to Boston	6	10
Farther out	4	6
Massachusetts - other	3	5
Out of the state	7	22
Do not know	13	23
Total	100	100
Number households answering	2044	1961

Satisfaction of Wayland residents with suburban life is reinforced by the migration patterns of former town residents illustrated by the data in Table 4.

Table 4 - Wayland Migration Pattern

Where Previous Occupant Moved	Households	Percent
Wayland	168	19
Framingham	46	5
Natick	44	5
Weston	18	2
Waltham	15	2
Wellesley	6	1
Lexington	4	a)
MDC Boston - other	91	10
Sudbury	26	3
Lincoln	6	1
Concord	6	1
Massachusetts - other	108	12
New England - other	66	8
West - California	35	4
South - Florida	37	4
United States - other	110	13
Foreign country	16	2
Death	71	8
Total	873	100
Do not know	170	-
No previous occupant	867	-
No answer	301	-
Total households	2211	

a) Less than 0.5 per cent

G. Transportation and Communications : Relation of the Part to the Whole

Wayland's commuting patterns illustrate the willingness of the suburban dweller to travel considerable distances to employment as long as he can maintain his residence in a country atmosphere. Eighty-six per cent of the households reporting have outgoing commuters to some 72 cities and towns in Massachusetts. Nearly one out of four commuters goes to Boston.

Table 5 - Commuting

Households Having	Percent Distribution of 2172 Households
Commuters out of town	86
No commuters out of town	14
Total	100

(For destinations of out-of-town commuters, see Appendix Table IX.)

Tabulations were also made of the number of cars per family and of the routes and times used regularly by commuters. (See Appendix Tables IX, X, XI, XII.) Although there is no previous study with which to compare these traffic patterns and chart the increases, the indication is clear that if the growth rate continues both in Wayland and its surrounding towns, an inescapable concomitant of more people will be more traffic.

H. Shopping, Professional Services, and Recreation

Wayland residents ignore the political boundaries of the town in more than employment commuting patterns. When the survey was taken, more Wayland groceries were bought in neighboring Natick than at home.[1] Five towns ranked higher than Wayland for shopping other than food. Over half the households in Wayland did no shopping for food in town; more than 4 out of 5 made no purchases of nonfood items there. Boston ranks high as a source of professional services and recreation, although 54 per cent of those replying stay in Wayland for some professional services, and (See Appendix Table XIV) 47 per cent for part of their recreation, although golf is the only available form of commercial recreation. Framingham, containing the most complete nearby shopping center, including branches of Boston stores, far outranks all towns for other shopping, with Boston rating second. When asked what other services they would like in Wayland, many residents expressed opposition to further commercialization of the town. Three out of four, however, wanted additional services. (Appendix Table XI)

I. The Telephone : The Medium

Next to the automobile, the most important convenience for any

---

[1] A new shopping center which includes a supermarket and other shopping services has opened in Wayland since the survey was made and has undoubtedly altered some of these patterns.

suburban household is the telephone. Wayland, a major unit in the suburban population bulge in Greater Boston, occupies a special relationship to the area where its wage-earners work, its housewives shop, and families receive professional services. There are three telephone exchanges in town, each with a different toll-free calling area. Two exchanges within the town are not mutually toll-free; Boston is a toll call for all. Ninety-eight per cent of the homes surveyed have telephones. Fifty per cent of the respondents named Wayland as the town most frequently called, but 25 per cent named a Boston area exchange for which they pay toll as the town most often called. Even more named Boston exchanges as the second and third most often called. Over half of those with telephones had no comments on the telephone service. The 44 per cent who did comment include 6 per cent who praised the service, and 38 per cent who criticized it. Most of the dissatisfaction (one out of four subscribers) was with the extent of the toll-free calling area.

J. Vacation Patterns : Escape or Recreate

Seventy-six per cent of the Wayland residents who take vacations go away in the summer months. Twenty-two per cent specify no vacations at all. This fact may partly account for the substantial interest shown in acquiring recreational land in answer to the Planning Board's question.

K. Preserving the Image : Can They Keep It?

The final tables are based on questions included in the survey at the request of the Wayland Planning Board. They gave the townspeople an opportunity to express themselves on the change or preservation of certain specific aspects of the town character. Some of these would have to be approved by town-wide vote; others, at the discretion of the popularly elected Planning Board members. A majority of the people in town registered themselves in favor of preserving the residential atmosphere of the town; 52 per cent were opposed to more industry, 71 per cent were opposed to apartment housing, and 72 per cent were in favor of the acquisition by the town of land for recreation or wild life preservation.

The last question probed gently into the suburbanites' sense of identification with the central city. Their response showed that when 3,000 miles from home, they are four times more likely to identify with Boston than when they are in a neighboring state. (Table 10)

Table 6 - Do you favor the Town's acquiring land for recreation and/or wild life?

	Recreation		Wild Life	
Answer	Households	Percent	Households	Percent
Yes	1589	72	1590	72
No	413	19	412	19
Do not know	58	2	52	2
No answer	151	7	157	7
Total	2211	100	2211	100

Table 7 - Would you favor a certain amount of tax money being used for this purpose (recreation and/or wild life) each year?

Answer	Households	Percent
Yes	1346	61
No	548	24
Do not know	81	4
No answer	236	11
Total	2211	100

Table 8 - Do you think that there should be more sidewalks in town?

Answer	Households	Percent
Yes	1159	52
No	871	39
Do not know	86	4
No answer	95	5
Total	2211	100

If so, where? (sidewalks) Answers to this question were not tabulated because they tended to relate to the immediate neighborhood in which each respondent lived. Many answers did specify main highways, within one mile of schools, in housing developments, and around shopping areas.

Table 9 - Would you like to see:

	Yes	No	Do not Know	No Answer
More industry in Wayland?	877	1164	75	95
Apartment housing?	452	1566	78	115
Old age housing?	940	949	158	164
More individual housing above $20,000?	1264	654	108	185
More small house development?	484	1519	57	151
More rental property?	595	1353	101	162
Percent (2211 households = 100%)				
More industry in Wayland?	40	52	3	5
Apartment housing?	20	71	4	5
Old age housing?	43	43	7	7
More individual housing above $20,000?	57	30	5	8
More small house development?	22	69	2	7
More rental property?	27	61	5	7

Table 10 - Identification

If you were in New Hampshire and someone asked where you were from, what would you answer?

If you were in California and someone asked where you were from, what would you answer?

Answer	Number if in N.H.	Number if in Calif.	Percent if in N.H.	Percent if in Calif.
Cochituate	208	64	10	3
Cochituate, near Boston	14	14	1	1
Cochituate, related to another place	99	66	4	3
Wayland	721	171	33	8

(Continued)

Table 10 - Identification (Continued)

If you were in New Hampshire and someone asked where you were from, what would you answer?

If you were in California and someone asked where you were from, what would you answer?

Answer	Number if in N.H.	Number if in Calif.	Percent if in N.H.	Percent if in Calif.
Wayland, near Boston	72	129	4	6
Wayland, near ___(other suburb)	19	9	1	a)
Wayland, Massachusetts	517	267	24	12
Near ___(other suburb)	26	15	1	1
Boston area	99	299	4	14
Boston	134	516	6	24
Massachusetts	233	560	11	26
N.E., East or Northeast	3	38	a)	1
Place of origin	16	14	1	1
Total	2161	2162	100	100
No geographical answer	50	49	--	--

a) Less than 0.5 per cent

APPENDIX - STATISTICAL TABULATIONS

Character of the Growth

I. When the adults now living in Wayland came to the town

Came to Wayland	Percent of 4601 Adults
Less than 5 years ago	44
Between 5 and 10 years ago	26
Between 10 and 20 years ago	13
More than 20 years ago	17
Total	100

II. Where the adults living in Wayland grew up

Place	Percent of 4590 Adults	Cumulative Percent
Wayland	9	9
MDC Boston	40	49
Massachusetts - other	14	63
New England - other	10	73
NY, NJ, Del, Pa, Md, DC	11	84
United States - other	10	94
Other country	6	100
Total	100*	

*In some tables the percentage column does not add up to 100, due to rounding errors.

III. Where adults who have come to Wayland in the last five years were living five years ago.

Place	Percent of 1988 Adults	Cumulative Percent
MDC Boston	58	58
Massachusetts - other	8	66
New England - other	7	73
NY, NJ, Del, Md, Pa, DC	13	86
United States - other	11	97
Other country	3	100
Total	100	

IV. Household size: Wayland's average household has 3.96 persons. The range is from 1 to 16 persons.

Persons Per Household	Percent of 2211 Households
1	3
2	18
3	17
4	28
5	19
6	9
7	4
8	2
9 or more	1
Total	100

V. Distribution of the population by age

Age	Percent of 8744 Persons
18 or under	45
Over 18	55
Total	100

VI. Distribution of the population by sex

Sex	Percent of 8744 Persons
Male	49.8
Female	50.2
Total	100.0

VII. Children per household

Children Per Household	Total Households	Percent
0	590	27
1	380	17
2	571	26
3	375	17
4	184	9
5	59	3
6	28	1
7	6	a)
8	3	a)
9	1	a)
10	0	0
11	2	a)
Total	2199*	100

*This figure differs from the 2,211 figure for households in Table IV because 12 households did not report in response to this question.

a) Less than 0.5 per cent.

VIII. Why residents would leave Wayland or the Boston area

Reasons for Leaving	Wayland Number of Households	Wayland Percent of Households	Boston Area Number of Households	Boston Area Percent of Households
Employment status changed	720	35	795	46
High taxes	356	17	138	8
Don't like overcrowding/changes/ people	108	5	57	3
More suitable housing/elsewhere	91	4	12	1
Poor transportation/to be nearer work	78	4	5	a)
Don't like local gov't/services	49	2	0	0
High cost of living	35	2	19	1
Prefer other place	32	2	17	1
To be nearer city	27	1	0	0
Quality of schools	27	1	-	-
Poor climate/health	20	1	31	2
Family changes (family elsewhere)	12	1	10	1
Don't like state government	3	a)	10	1
Wayland not in Boston area	0	0	7	a)
Total reasons	1558	75	1101	64
Total households specifying reasons	1425	69	1040	61
No reason to leave	648	31	675	39
Total households answering	2073	100	1715	100
Households not responding	138	--	496	--

a) Less than 0.5 per cent

IX. Destinations of out-of-town commuters

Town	Number	Percent
Boston	558	24
Waltham	310	13
Framingham	195	9
Natick	155	7
Cambridge	143	6
Newton	135	6
Wellesley	85	4
Watertown	59	3
Weston	36	2
Concord	34	2
Bedford	33	1
Needham	33	1
Sudbury	27	1
Burlington	25	1
Lexington	24	1
MDC towns less than 1 per cent each	123	5
Other destinations	123	5
Destination varies	214	10
Total	2312	100

X. Car ownership

	Cars in Family		Cars at Home During Day	
Cars Per Family	Families	Percent	Families	Percent
0	78	3	875	42
1 (part-time)	0	0	112	6
1	1054	48	1028	50
2	961	44	44	2
3	81	4	5	a)
4 or more	17	1	0	0
Total	2191	100	2064	100
No answer	20	--	147	--

a) Less than 0.5 per cent

XI. Means of transportation of out-of-town commuters

	Percentage Distribution of				
Means	2244 Commuters	=	544 Commuters To Boston	+	1700 Commuters To Other Places
Car	87		65		94
Truck	1		--		2
Car and MTA	3		10		a)
Train	5		19		a)
Bus	3		4		3
Other	a)		--		a)
Means vary	1		2		1
Total	100		100		100
No answer	76		14		62

a) Less than 0.5 per cent

XII. Traffic Patterns: relative use of main routes by cars and trucks going out-of-town

Route	Number	Percent
U.S. 20 (east-west)	592	39
Mass. 30 (east-west)	485	32
Mass. 27 (north-south)	174	12
Mass. 126 (north-south)	248	17
Total	1499	100
Other, various routes and no answer	526	--

Note: Some commuters use a combination of the above routes; however, only those routes which were a point of exit and entry to town were tabulated.

XIII. Traffic Patterns: time pattern of car and truck commuters going out of town on east-west routes

	Percent of 592 Commuters		Percent of 485 Commuters	
	U.S. Route 20		Mass. Route 30	
Hour	East	West	East	West
A.M. before 6	1	1	3	1
6 up to 6:30	3	a)	3	1
6:30 up to 7	5	0	9	1
7 up to 7:30	18	a)	15	3
7:30 up to 8	29	1	24	4
8 up to 8:30	23	1	19	2
8;30 up to 9	7	1	4	1
9 up to 10	3	a)	3	1
10 up to 12	1	1	a)	a)
Varies	3	a)	3	1
P.M. 12 up to 4	2	2	3	5
4 up to 4:30	a)	4	2	2
4:30 up to 5	1	5	1	5
5 up to 5:30	1	18	4	12
5;30 up to 6	1	18	3	14
6 up to 6:30	1	23	1	23
6:30 up to 7	a)	9	1	10
7 up to 7:30	a)	5	a)	5
7:30 up to 12	1	3	1	3
Varies	0	9	1	6
Total	100	100	100	100

a) Less than 0.5 per cent

XIV. Towns Visited for Shopping, Professional Services, and Recreation

Shopping for Food, 2181 Households Answering	Number of Households Specifying the Town	Percent Households Specifying the Town	Number of Households that Visit the Town Specified				Rank Position of the Town for Purpose Described*
			less than 25% of the time	26-50% of the time	51-75% of the time	75-100% of the time	
Wayland	995	46	391	353	56	295	2
Boston	81	4	27	30	10	14	9
Framingham	668	31	74	269	84	241	3
Waltham	329	15	44	110	50	125	4
Natick	881	40	101	295	112	373	1
Newton	101	5	18	35	14	34	6
Sudbury	109	5	35	42	15	17	8
Wellesley	108	5	20	47	11	30	7
Weston	53	2	11	17	10	15	10
Other towns	145	7	49	49	15	32	5
Other Shopping, 2141 Households Answering							
Wayland	351	16	278	61	1	11	6
Boston	716	33	217	324	58	117	2
Framingham	1441	67	194	685	147	415	1
Waltham	536	25	130	293	23	90	3
Natick	365	17	92	213	20	40	5
Newton	54	3	22	22	1	9	8
Sudbury	24	1	15	6	0	3	9
Wellesley	432	20	133	258	7	34	4
Weston	19	1	14	4	0	1	10
Other towns	199	9	76	87	13	23	7

XIV. Towns Visited for Shopping, Professional Services, and Recreation (Continued)

Professional Services, 2157 Households Answering	Number of Households Specifying the Town	Percent Households Specifying the Town	Number of Households that Visit the Town Specified: less than 25% of the time	26-50% of the time	51-75% of the time	75-100% of the time	Rank Position of the Town for Purpose Described*
Wayland	1172	54	173	543	76	380	1
Boston	519	24	120	282	25	92	3
Framingham	421	20	145	172	16	88	4
Waltham	203	9	50	100	12	41	7
Natick	460	21	74	232	28	126	2
Newton	109	5	18	65	7	19	9
Sudbury	37	2	10	23	1	3	10
Wellesley	167	8	33	110	4	20	8
Weston	327	15	54	217	8	48	5
Other towns	256	12	82	123	9	42	6
Recreation 2005 Households Answering							
Wayland	955	47	139	360	97	359	1
Boston	682	34	173	341	30	138	3
Framingham	638	32	130	295	37	176	2
Waltham	80	4	24	36	3	17	6
Natick	203	10	57	97	8	41	5
Newton	41	2	14	22	0	5	9
Sudbury	20	1	14	6	0	0	10
Wellesley	56	3	9	33	1	3	7
Weston	40	2	8	21	4	7	8
Other towns	422	21	186	149	25	62	4

XIV. Towns Visited for Shopping, Professional Services, and Recreation (Continued)

*The following method was used to determine the rank order of towns. When a householder reported that he visited a town, say Framingham, to shop, he was also asked to report whether Framingham was used less than 25 per cent of the time, 25 to 50 per cent, 50 to 75 per cent, or 75 to 100 per cent of the time. A tabulation of these responses is shown in Columns 3 through 6 in the table.

Each of these four possible responses was assigned a point value, and these point values were used to calculate a total point score for each town. To illustrate, again using Framingham:

Frequency	Point Value	x	No. Households Reporting this Frequency	=	Point Score
Less than 25% of the time	1		74		74
25 to 50%	3		269		807
50 to 75%	5		84		420
75 to 100%	7		241		1687
Totals			668		2988

Thus Framingham, where 668 Wayland householders report they shop, receives a total of 2988 points. This point score reflects the fact that some households go there for a high proportion of their shopping trips, while other households go infrequently. Using the same weighting method, Natick got 4157 points when shopping was considered and Wayland itself received 3495. Thus as a place where Wayland households shop, Natick ranks first, Wayland ranks second, Framingham ranks third, and so on as shown in the table.

The same method was applied to calculate the ranking for Other Shopping, Professional Services, and Recreation.

XV. Vacation patterns: where

Vacation Taken in	Vacations Reported by 2121 Households	Vacations as a Percent of 2121 Households Answering
New England	1289	60
United States - other	343	16
Foreign	110	5
No single place, varies	217	10
Total vacations taken	1959	--
Households Answering	2121	100
Taking vacations	1649	78
No vacations	472	22
Households not answering	90	--

XVI. Evaluation of living in Wayland

Advantages	Percent of 2123 Households	Disadvantages	Percent of 2123 Households
Country living	34	Growth	3
Town small/suburban	10	Flavor of town	6
Spacious lots	8	Transportation	28
Quiet/private	6	Traffic	4
Pretty/pleasant	6	Telephone service	5
Native/family near/like	11	Taxes	20
Good for children/people	4	Lack of sewers/drainage	4
Flavor of town - other	8	Rubbish disposal	4
Near work	5	Far from work	1
Near Boston	7	Far from Boston	1
Shopping/services convenient/good	6	Shopping/services inconvenient	11
Convenient location/commuting good	10	Inconvenient location/commuting poor	4
Recreation	7	Recreation	5
Schools	25	Schools	5
Zoning	3	Zoning	1
Town gov't/services	4	Town gov't/services	8
Just like it	4	Wayland/Cochituate split	1
Households not responding	11	Households not responding	26

~~MARKETING RESEARCH~~
~~SHELF 1~~

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economic base reports

projections of greater boston's population to 1970 and 1980

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economic base report 9

projections of greater boston's population to 1970 and 1980

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greater boston economic study committee
ASSOCIATE CENTER OF THE COMMITTEE FOR ECONOMIC DEVELOPMENT
200 BERKELEY STREET, BOSTON 17, MASSACHUSETTS, JULY, 1962

GREATER BOSTON ECONOMIC STUDY COMMITTEE

The Greater Boston Economic Study Committee was founded in 1957. It is a private, nonprofit, nonpolitical research organization. The Study Committee has two basic objectives:

1. To increase public understanding of the economic forces and trends at work in Greater Boston by conducting and publishing objective and basic research on the region's economy.

2. To help the Greater Boston region achieve and sustain balanced economic growth by formulating policy recommendations which may both stimulate and advise leaders in metropolitan affairs.

The Committee presently has twenty members; seventeen are businessmen, one is a newspaper editor, and two are the deans of schools of business administration. The Study Committee has a small professional research staff and a Research Advisory Committee which helps guide its research program. The Research Advisory Committee is made up of leading business economists, university professors, and professionals in the field of planning and public administration.

In 1959 the Greater Boston Economic Study Committee became an Associate Center of the Committee for Economic Development. The Study Committee believes that this association has helped to broaden and strengthen its own program and organization.

To achieve its goals, the Committee issues public policy statements, economic base reports, and regional land use analyses.

In its policy statements, the Study Committee has made recommendations aimed at solving commuting problems in the metropolitan area, stimulating economic growth in downtown Boston, and financing local government in the decade ahead.

The regional land use studies have been devoted to compiling detailed land use data for each of the 153 cities and towns in the Greater Boston region, and to projecting industrial land needs through 1980. As part of this research effort, GBESC has published a full color land use map of the Greater Boston Area.

In the economic base series population trends, the labor force, rapid transit ridership, business displacement in urban renewal areas, socio-economic patterns in growing suburban communities, and the participation of business executives in civic affairs have been analyzed. Projections of Greater Boston's Population to 1970 and 1980 supercedes all previous GBESC publications in the field of regional population analysis.

projections of greater boston's population to 1970 and 1980

TABLE OF CONTENTS

Page

PREFACE v

A SUMMARY OF FINDINGS vii

PROJECTIONS OF GREATER BOSTON'S POPULATION TO 1970 AND 1980

I. INTRODUCTION 1

II. "HIGH" AND "LOW" PROJECTIONS 2

III. ANALYSIS OF PROJECTED CHANGES 6

IV. PROJECTION METHODS 14

APPENDIX A. 1960 POPULATION OF THE GBESC STUDY AREA BY AGE AND SEX 20

APPENDIX B. ESTIMATED MIGRATION INCREMENTS AND DECREMENTS IN THE GBESC AREA, 1960 21

APPENDIX C. PROJECTED CRUDE BIRTH RATES, UNITED STATES AND GBESC AREA 22

REVISED 1970 POPULATION PROJECTIONS FOR 153 CITIES AND TOWNS IN THE GBESC STUDY AREA 23

PREFACE

Projections of Greater Boston's Population to 1970 and 1980 supercedes all of the Greater Boston Economic Study Committee's publications to date in the field of population projection and analysis As the earlier projections have been widely used, it will be helpful to clarify the relationship between this report and the three others which have been published.

In June, 1959, Economic Base Report No. 2 presented The Population of Greater Boston Projected to 1970, and in December, 1959, Economic Base Report No. 4, The Population of the Cities and Towns of Greater Boston Projected to 1970 was released.

As is obvious from their publication dates, both of these documents predated the 1960 census, and earlier data were used to develop the migration and fertility assumptions required to make the regional projection. The city and town projections were made by allocating the regional total among the 149 communities in the Study Area. To do this, it was necessary to make estimates of the current, i.e. 1959, population, and this was done by canvassing utility companies, local governments, housing authorities, planning boards, etc.

When the 1960 Census enumerations were published, it was revealed that GBESC's estimated 1960 population was less than one per cent off the actual count. But as was to be expected, individual city and town estimates were not as accurate. In general, trends had been underestimated, that is, growth in expanding communities and decline in contracting cities and towns was understated.

As the individual community estimates were widely used, the Study Committee undertook a revision of them as soon as the 1960 city and town Census enumerations became available, and the revision was published as a news release, Revised 1970 Population Projections

For the 149 Cities and Towns in the Greater Boston Economic Study Area, February, 1961. The control total for the Area was, however, not altered, and indeed, could not be changed on any reasonable basis until the age-sex breakdowns necessary for projection became available. Furthermore, in view of the virtual identity between GBESC's estimate of the total 1960 population of the Area and the subsequent Census count, revising the control total did not appear to be a particularly urgent prerequisite for revising the individual city and town estimates.

In this report the population of the Greater Boston Area is for the first time projected to 1980. This undertaking automatically yields a new figure for 1970, and though the change in the population now projected for 1970 is very small, the Study Committee has taken this occasion to adjust the first revision of the individual city and town estimates so as to release one consistent set of population data.

It should also be noted that during the period of these population studies the Study Area itself was redefined by the inclusion of four communities, and the projections in this report are for this expanded Area.

Lastly, a word on authorship. Economic Base Report No. 2 and Projections of Greater Boston's Population to 1970 and 1980 were commissioned by GBESC and were carried out by Professor Frank L. Sweetser of Boston University. He has also given us the benefit of his judgment in connection with the preparation of individual community estimates. These are, however, the work of the Greater Boston Economic Study Committee staff.

Ralph Kaminsky
Director of Research

A SUMMARY OF FINDINGS

This report presents projections of the population of the Greater Boston Economic Study Committee's Study Area to 1970 and 1980. Two projections based on different assumptions with respect to fertility rates and migration patterns are developed. Taken together, they define the limits of "high" and "low" growth rates not likely to be exceeded in the light of present knowledge.

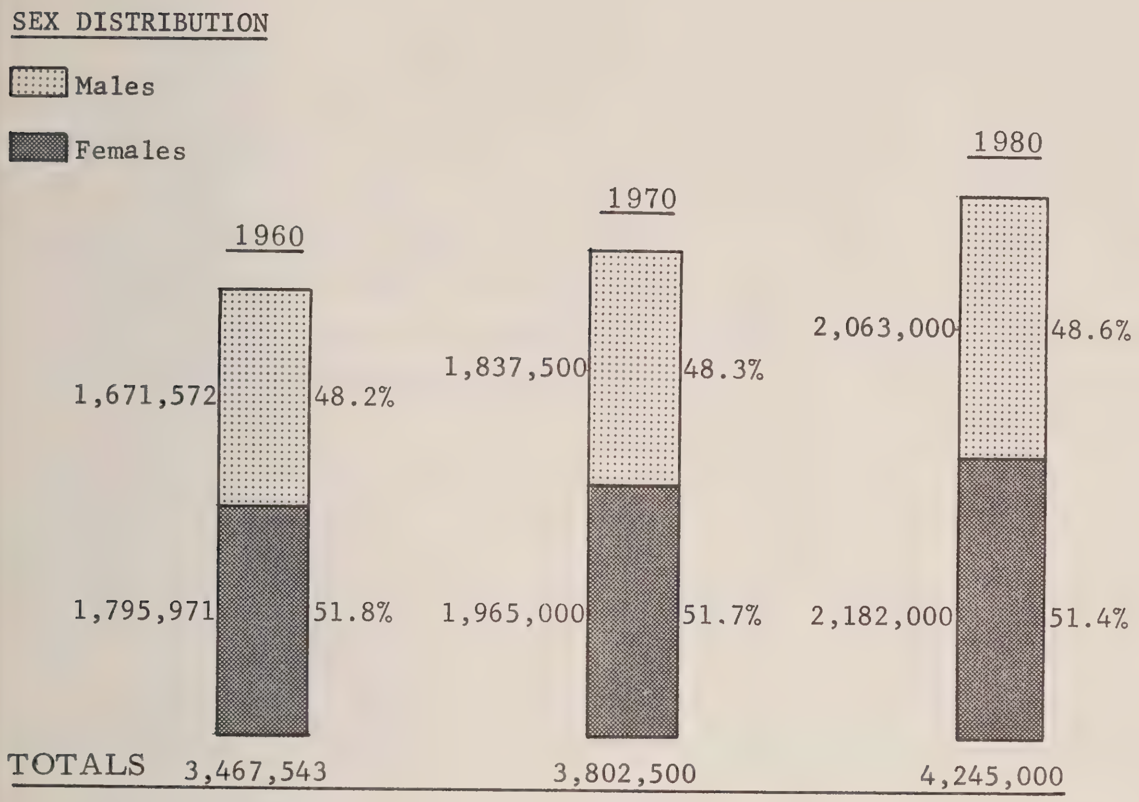
The mean of the two projections is considered the "most probable" future population of the Study Area, and on this basis it is projected that the regional population will be 3,802,500 in 1970 and 4,245,000 in 1980. As the 1960 Census revealed, as there were 3,467,543 people in the Greater Boston Area in 1960, the projected growth rate to 1970 is 9.7%, a figure identical to that for the period 1950 to 1960. In contrast, the "most probable" rate of increase in the decade of the 1970's is higher, 11.6%, and for the entire twenty-year period, it is 22.4%.

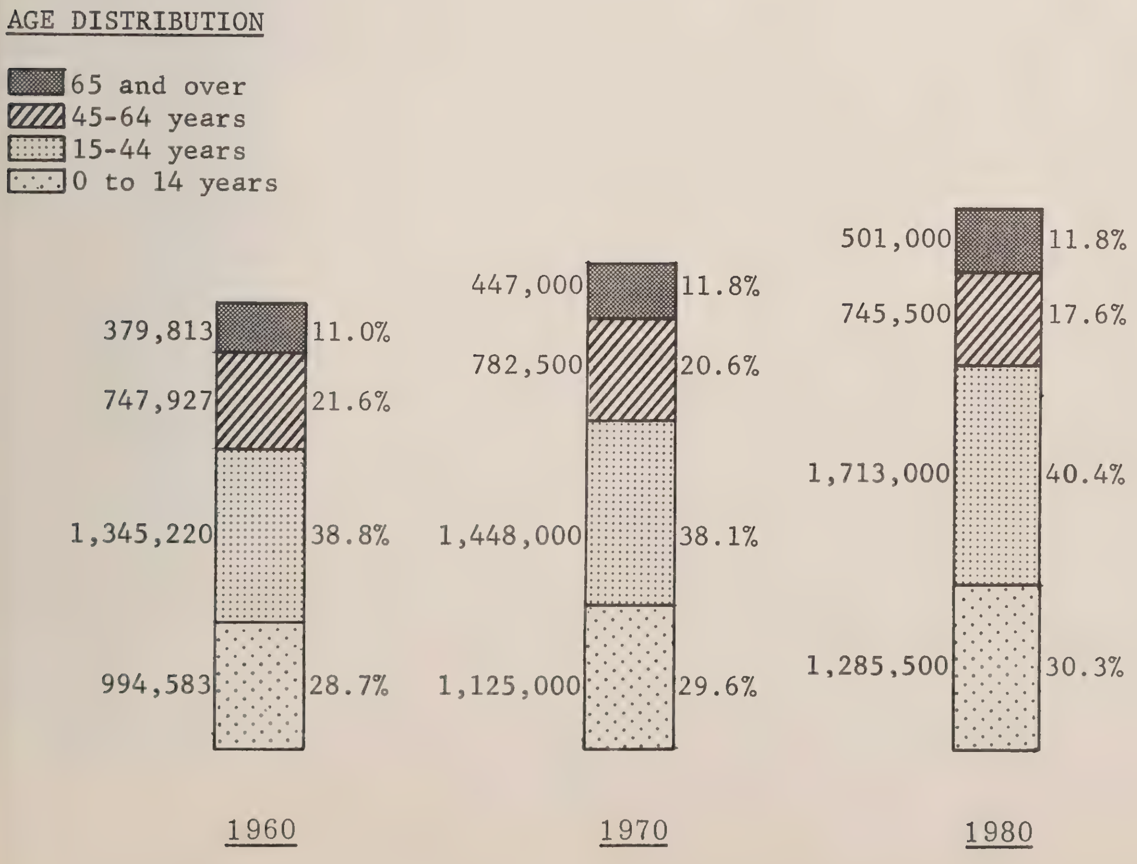
The most nearly comparable projections for the United States as a whole indicate growth of just over 44% for the two decades, 1960 to 1980. Thus the Greater Boston Area is expected to experience population increases at about half the national rate. In addition, it now seems likely that the GBESC Area will increase slightly less rapidly than the State of Massachusetts as a whole, and its share of the State's population may decline very slightly during the next twenty years.

Age groupings will show important differences in growth with young adults (age 15-44 years) increasing in numbers very rapidly and older adults (ages 45-64) increasing only slowly until 1970 and stabilizing or declining thereafter. Numbers under 15 years and over 65 years will also show marked increases, both absolutely and in percentage terms. Indeed, the rate of crease in these categories may possibly exceed the 15-44 year group even though absolute gains are smaller. In spite of these rather marked relative and absolute changes, the age distribution of the Area's population as projected will not be altered by more than a few percentage points.

IGURE 1 POPULATION OF THE G B E S C STUDY AREA PROJECTED TO 1980

The 1970 and 1980 figures are the average of the high and the low projections found in the text.





Sex ratios are projected as showing some increase in the proportions of males in the adult age groupings, 15-64. But the ratio for the very young is projected to remain nearly stable with a small male excess. For ages 65 and over, a continuing decline in proportions of males is anticipated. On balance, however, it is expected that the population will experience a small increase in the proportion of males but that females will still predominate. A sex ratio of 94.5 males per 100 females is projected for 1980.

projections of greater boston's population to 1970 and 1980

I. INTRODUCTION

In June, 1959, the Greater Boston Economic Study Committee released its Economic Base Report No. 2, which projected the GBESC Area's population from 1950 to 1960 and 1970 by age and sex. Now, after two and a half years, the time is propitious for a re-examination of prospects for future population growth. Not only is a periodic review of population projections a necessity, if they are to continue to serve a useful function in economic and social planning, but in the present instance, several factors combine to make the present study especially timely.

There is, first and foremost, the availability of detailed 1960 U. S. Census data. These new data are not only valuable as a point of departure, but they make it possible to develop new projection assumptions relating to migration and fertility rates which realistically reflect recent experience. While national population projections are not greatly influenced by differing migration assumptions, since the range of probable variation is small, local population estimates are. For Greater Boston, the 1950-1960 experience shows a substantial net out-migration,[1] contrasting with the previous assumption -- based on the best data then available -- of a small net in-migration.

New data on births in the area also reveal trends different from those previously assumed. In the earlier projections the 1955 level was taken as the standard. The new data, however, show that fertility rates have risen in the late 1950's.

As the revised birth rate assumptions which are based on them tend to inflate the new projections while the revised migration assumptions tend to deflate them, their combined net effect is less on the projected total population than it is on projected age-distributions. Assuming

---

1. Cf. Appendix B.

higher future fertility tends to increase the projected numbers of youngsters, whereas assuming more out-migrants affects the projected number of adults.[1]

A second important modification of the previous study, now possible, is the extension of the projections for an additional decade, to 1980. Lastly, the GBESC Study Area has been modified by the addition of four communities, and it now includes 153 cities and towns.[2] The new projections are made for this expanded area.

Two new projections are presented in the next section of this report; projected changes are analyzed in Section III, and the component method of projection is outlined in Section IV.

II. "HIGH" AND "LOW" PROJECTIONS

In the development of the new projections, an effort was made to select two sets of fertility and migration assumptions which would reflect probable limits of rapid and slow population growth. Thus two projections are presented, a "high" projection in Table IA and a "low" projection in Table IB. Since these projections are assumed to be the probable extremes of rapid and slow growth, the "most likely" future experience falls, by definition, somewhere between them. As we move into the decade of the 1960's, it is to be expected that new information concerning migration and fertility patterns will provide criteria for preferring either a somewhat higher or a slightly lower estimate of future population for the Area, though the figure will still probably fall

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1. Comparison of the earlier projections for 1960 with the 1960 Census results shows that the total was within 19/100 of 1% of the enumerated figure; but numbers of adults were from 1-4% above the Census in broad age categories; whereas numbers of children under 15 were 4% less than the Census. Obviously, these differences arose from the use of assumptions as to fertility and migration which were not experienced in fact.

2. The additional communities are Amesbury, Merrimac, Newburyport, and Salisbury.

TABLE IA. THE POPULATION OF GREATER BOSTON PROJECTED TO 1980

"HIGH" PROJECTION

	Age Group	1960	1970	1980
Male				
	0-14	507,221	595,000	713,000
	15-44	658,218	720,000	863,000
	45-64	348,765	371,000	364,000
	Over 64	157,368	179,000	198,000
	All Ages	1,671,572	1,865,000	2,138,000
Female				
	0-14	487,362	573,000	687,000
	15-44	687,002	737,000	878,000
	45-64	399,162	415,000	391,000
	Over 64	222,445	270,000	307,000
	All Ages	1,795,971	1,995,000	2,263,000
Total Population				
	0-14	994,583	1,168,000	1,400,000
	15-44	1,345,220	1,457,000	1,741,000
	45-64	747,927	786,000	755,000
	Over 64	379,813	449,000	505,000
	All Ages	3.467,543	3,860,000	4,401,000

Sources: 1960 U. S. Population Census, Volume I, Characteristics of the Population Bulletin PC (1) 23B and Special Table PH-1 (unpublished) for Census Tracts and minor civil divisions in the GBESC Area.

ABLE IB. THE POPULATION OF GREATER BOSTON PROJECTED TO 1980

"LOW" PROJECTION

	Age Group	1960	1970	1980
ale				
	0-14	507,221	551,000	597,000
	15-44	658,218	712,000	838,000
	45-64	348,765	369,000	357,000
	Over 64	157,368	178,000	196,000
	All Ages	1,671,572	1,810,000	1,988,000
emale				
	0-14	487,362	531,000	574,000
	15-44	687,002	727,000	847,000
	45-64	399,162	410,000	379,000
	Over 64	222,445	267,000	301,000
	All Ages	1,795,971	1,935,000	2,101,000
otal opulation				
	0-14	994,583	1,082,000	1,171,000
	15-44	1,345,220	1,439,000	1,685,000
	45-64	747,927	779,000	736,000
	Over 64	379,813	445,000	497,000
	All Ages	3,467,543	3,745,000	4,089,000

Sources: 1960 U. S. Population Census, Volume I, Characteristics of the Population Bulletin PC (1) 23B and Special Table PH-1 (unpublished) for Census Tracts and minor civil divisions in the GBESC Area.

within the range set by these "high" and "low" limits. At present, however, and in the absence of such criteria, it is suggested that the mean of the two yields the "most probable" estimate of future population. Thus, for 1970, the "most probable" population is 3,802,500, and for 1980, it is 4,245,000.

As there were 3,467,543 people in the Greater Boston Area in 1960, the projected growth rate to 1970 is 9.7%, a figure identical to that for the period 1950 to 1960. In contrast, the "most probable" rate of increase in the decade of the 1970's is higher, 11.6%, and for the entire twenty-year period, it is 22.4%.

The "low" and "high" projections imply corresponding rates of population increase. When the "low" projection is assumed, growth projected for the 1960's is at a rate of 8.0%, 9.2% in the 1970's, and at a rate of 17.9% for the entire 20-year period. Assuming the "high" projection, it yields rates of 11.3%, 14.0%, and 26.9%, respectively.

Two aspects of these projections stand out as particularly important. First, on either set of assumptions, the population dynamics of the GBESC Area indicate that continuing substantial growth may be expected but at rates not very different from those of the decade just past. Second, more rapid growth may be expected in the 1970's than in the 1960's. This cumulative thrust of population growth is the expected consequence of the aging of the large numbers of youngsters who have been born since the second World War. As today's large cohorts of adolescents and children move into young adulthood, marry, and begin to raise their own families, a relatively large absolute number of births may be expected even though birth rates may be lower. This effect will begin to be felt in the last few years of the 1960's, and it will influence the size of the 1970 population by tending to offset probable larger out-migrations. The full effect will, however, become apparent only in the 1970's.

III. ANALYSIS OF PROJECTED CHANGES

Population Growth Projected for Greater Boston and Other Areas

For the twenty-year period, 1960-1980, the projected "most probable" rate of increase for the GBESC Area is 22.4%. This compares with a 1960-1980 rate of growth of 44.3% for the United States according to the Census Bureau's most recent, and most nearly comparable, projection.[1] Thus while the growth projected for Greater Boston is as high or higher than it has been in the recent past, the rate is just over half as great as for the United States as a whole.

Table II shows projected rates of population increase for the GBESC Area, the United States, and the New England states for the decade 1960-1970. For this decade, as for the twenty-year period, the projected GBESC growth rate, 9.7%, is only slightly more than half that projected for the nation as a whole. This rate is about a third of the rate projected for Connecticut, a high in-migration state,[2] lower than the rate for New Hampshire, the same as for Rhode Island, and higher than the rates for Maine or Vermont.

But perhaps the most interesting comparison is that between

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[1] Series II of "Illustrative Projections of the Population of the United States, by age and sex, 1960 to 1980," Current Population Reports, Series P-25, No. 187, dated November 10, 1958. This Census Bureau projection assumes a level of fertility approximately midway between the high and low fertility assumptions of the two GBESC projections, and uses similar mortality assumptions. Although the Census Bureau in CPR P-25, No. 232 (6/22/61) and No. 241 (1/17/62) has developed revisions of its "Illustrative Projections," the first is limited to the projection of school and college enrollment and was prepared before the 1960 enumeration became available; and the second is an interim correction which carries only to 1970. A letter from Dr. Jacob S. Siegel, Chief of the Population Estimates and Projections Branch of the Census Bureau indicates that the Bureau has plans for preparing revised projections to later years during 1962, but these are not yet available.

[2] Connecticut is estimated to have gained 234,000 persons as net migrants between 1950 and 1960, as compared to a loss of 73,446 for the GBESC Area. Cf. CPR Series P-25, No. 227 (4/26/61) Table 3, and Appendix B, below.

the GBESC Area and Massachusetts as a whole. It is estimated that the population increase in Massachusetts as a whole is occurring at a rate approximately one-fourth greater than in the GBESC Area. This difference is attributed largely to the fact that some 73,000 of the State's 93,000 out-migrants[1] will come from the GBESC Area. While the GBESC Area had two-thirds of the State's population in 1960, it had four-fifths of its out-migration between 1950 and 1960.

TABLE II. PROJECTED RATES OF POPULATION INCREASE, 1960 TO 1970: COMPARISON OF GBESC AND OTHER AREAS

U. S. and Divisions	Rate of Increase
GBESC Area ("most probable")	9.7%
United States	19.1
Connecticut	27.6
Maine	7.9
Massachusetts	12.6
New Hampshire	15.0
Rhode Island	9.8
Vermont	4.1

Sources: GBESC Area "most probable" is the percent increase from 1960 to the mean of the 1970 "high" and "low" projection totals. All other data from "Population Projections 1960-1970," Research Division, National Education Association, June, 1961, which contains unofficial figures "prepared by the Bureau of Census at the request and expense of the National Education Foundation . . . figures are not to be attributed to the Bureau of the Census." Fertility assumptions are approximately midway between the GBESC "high" and "low" fertility assumptions and net migration is the 1950-1960 experience, as in the GBESC "high" projection.

As a consequence of these differential migration rates, it appears

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[1] Loc. cit.

probable that the proportion of Massachusetts population in the GBESC Area will diminish very slightly during the projection period. In 1960 the Study Area's share was 67.3%. The National Education Association has projected a total population of 5,799,000 persons for Massachusetts in 1970[1] and based on this figure, the GBESC Area's "most probable" share will decline to 65.6%.

Changing Age Composition of the GBESC Area

Another interesting aspect of projected population change for the GBESC Area is the prospective shifting of age distributions during the coming two decades. These shifts may be examined from several perspectives. If the data of Table I are taken as the point of departure, it will be found that the age groupings vary greatly, both in projected absolute increments or decrements as well as in projected rates of change. These aspects of age redistribution are discussed in greater detail below.

Though absolute and percentage changes are expected to vary greatly among the age groupings, the distribution of the population among the age groupings will not be affected significantly. Table III presents a comparison of the per cent distribution for the 1960 Census population with the corresponding distributions for the "high" and "low" projection for both 1970 and 1980. The general impression this table gives is that there are no radical changes in the gross age structure of the population projected on either a "high" or a "low" basis. Furthermore, except for those under 15 years, the "high" and "low" projections indicate similar trends when the 1960 and 1980 distributions are compared. Both projections show an increase in the proportion of persons in the late adolescent and young adult ages, 15-44 years; a decrease in the proportion of adults in the later working ages, 45-64; and an increase in the proportions

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[1] op, cit.

TABLE III. PERCENTAGE AGE DISTRIBUTIONS FOR 1960 AND FOR THE "HIGH" AND "LOW" PROJECTIONS TO 1970 AND 1980

		Projections			
	Census	"HIGH"		"LOW"	
Ages	1960	1970	1980	1970	1980
0-14	28.7%	30.3%	31.8%	28.9%	28.6%
15-44	38.8	37.7	39.6	38.4	41.2
45-64	21.6	20.4	17.2	20.8	18.0
Over 64	11.0	11.6	11.5	11.9	12.2
All Ages	100.0%	100.0%	100.0%	100.0%	100.0%

Sources: U. S. Census, GBESC Tables IA and IB.

in the retirement ages, 65 years and over. For the age grouping 0-14, the "high" projection indicates an increase in proportion of the total, whereas the "low" projection shows virtually no change from 1960. If the mean of the two projections is used, only small proportionate gains are shown for those under 15 years and over 65 years. The principal change is in the distribution of the active population. The share in the 15-44 age group increases while a percentage decline would be indicated for the 45-64 age category.

Differentials in absolute increments and decrements of persons in the several age groupings are large as Table IV shows. Looking first at the changes projected for the age grouping 15-44 years, it is clear that a substantial increment, more than a third of a million, is anticipated for the period from 1960-1980, regardless of which projection is preferred. This, of course, will be the direct consequence of the aging of the large numbers of youngsters both now in the Area and to be born between 1960 and 1965 -- a period for which relatively high birth rates are assumed in both projections.[1] Moreover, when the two

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[1] The difference between the projections is largely due to the assumption of 50 per cent more out-migration in the "low" projection than in the "high." See discussion of migration assumptions Part IV, below.

TABLE IV. PROJECTED INCREASES IN THE POPULATION OF GREATER BOSTON BY AGE

(figures are in thousands)

	"High" Projection			"Low" Projection		
Ages	1960-1970	1970-1980	1960-1980	1960-1970	1970-1980	1960-1980
0-14	173	232	405	87	89	176
15-44	112	284	396	94	246	340
45-64	38	-31	7	31	-43	-12
Over 64	69	56	125	65	52	117
All Ages	392	541	933	277	344	621

Sources: U. S. Census, GBESC Tables IA and IB

decades of change are separately examined, it is seen that while the increase in this age grouping is substantial in both decades, it is more than twice as great in the 1980's as in the 1970's for both projections. This phenomenon illustrates the cumulative effect of the aging processes which is just now beginning to bring the large numbers of post-war babies into late adolescence. By 1970 those born between 1945 and 1950 will be 20-25 years old, and by 1980, 30-35 years old. Since numbers born in each successive five-year period after the war have increased up to the present, this first post-war five-year cohort now entering late adolescence will with certainty be followed by successively larger cohorts, up to 1970, (these youngsters are already born), and almost certainly up to 1980. The economic and social significance of this burgeoning of our population of young adults is apparent in relation to labor market and job needs, educational and vocational training requirements, and demands for varied goods and services. In many ways, the coming-of-age of these youngsters will require a reorientation of social and economic planning -- the more so since this is the very age group which, between 1950 and 1960, experienced an actual decline of 39,000 in the GBESC Area.

The increase projected for those 0-14 years is over 400,000 for

the "high" projection, 1960-1980; but less than 200,000 for the "low" projection. This is the only age grouping in which the two projections show a substantial difference -- a difference which arises almost entirely from the higher birth rates assumed in the "high" projection.[1] All of those who will be under 15 in 1980, and most of such persons in 1970, are yet to be born, so that the fertility assumptions are the crucial determinants of the projection results. It will be noted that although this increment averages substantially less than the increment for the young adults in both projections, it is still large and indicates a continuing expansion in needed services for the very young and the early school ages during the next two decades. When the "high" projection is assumed, the increment is considerably larger for the 1980's than it is for the 1970's though they are about the same size for the "low" projection. On the average then, it would seem "most probable" that the increment of youngsters will be appreciably greater from 1970 to 1980 than from 1960 to 1970.

Projected changes in the population age 65 and over are very similar for the two projections, and fairly substantial for both. The GBESC Area population in the retirement ages may be expected to increase by well over a hundred thousand in the years between 1960 and 1980, with a somewhat larger increase in the first decade than in the second. Essentially, this indicates a continuation of past growth trends for the age group, with a gradual slowing down in volume of growth.

Finally, Table IV shows that the age grouping 45-64, the older working ages, may be expected to show a small increase from 1960 to 1970 followed by an approximately counterbalancing decline from 1970 to 1980. This is indicated by both the "high" and "low" projections. The twenty-year period may show a slight loss or a slight gain for this age grouping, but not any major changes are likely unless there

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[1] See Part IV, below.

TABLE V. PROJECTED RATES OF INCREASE IN THE POPULATION OF GREATER BOSTON BY AGE

	"High" Projection			"Low" Projection		
Ages	1960-1970	1970-1980	1960-1980	1960-1970	1970-1980	1960-1980
0-14	17.4%	19.9%	40.8%	8.8%	8.2%	17.7%
15-44	8.3	19.5	29.4	7.0	17.1	25.3
45-64	5.1	-3.9	.9	4.2	-5.5	-1.6
Over 64	18.2	12.5	33.0	17.2	11.7	30.9
All Ages	11.3%	14.0%	26.9%	8.0%	9.2%	17.9%

Sources: U. S. Census, GBESC Tables IA and IB

is radical alteration of the migration or mortality patterns. These minor shifts for the older middle ages are due to the effects of aging, and the declines projected for the 1980's simply reflect the movement of the depression cohorts of the 1930's into the age grouping. The differences between the two projections are entirely due to differing migration assumptions.[1]

Table V shows per cents of increase (or decrease) for the several age groupings according to both projections. For the most part, the data thus described merely reinforce conclusions already stated. It should, however, be noted that for both projections the percentage increase between 1960 and 1980 in the 65 and over age group is higher than it is for ages 15-44 and also averages higher than for the age group 0-14 for the two projections. In terms of rates of increase from 1960 to 1980, then, it is important to recognize that the old age category ranks first, the young adults group is a close second, youngsters are third, while the older working adults rank last in percentage increase as relatively little change is projected.

Projected Sex Composition

While there are no pronounced shifts in the balance of births

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[1] See Part IV, below.

and deaths in Greater Boston's population as here projected to 1980, there are some interesting minor trends indicated. Sex ratios, i.e. numbers of males per 100 females, in 1960 and projected 1970 and 1980 will be about the same. This is shown in Table VI.

TABLE VI. SEX RATIOS* IN GREATER BOSTON, 1960, AND AS PROJECTED TO 1970 AND 1980 "HIGH" AND "LOW" ASSUMPTIONS, GBESC AREA

	Projections				
	Census	"HIGH"		"LOW"	
Ages	1960	1970	1980	1970	1980
0-14	104.1	103.8	103.8	103.8	104.0
15-44	95.8	97.7	98.3	97.9	98.9
45-64	87.4	89.4	93.1	90.0	94.2
Over 64	70.7	65.9	64.5	66.7	65.1
All Ages	93.1	93.5	94.5	93.5	94.6

Sources: U. S. Census and GBESC Tables IA and IB

* The sex ratio is the number of males per 100 females

For the total population, a slight rise in the proportion of males is anticipated. In the active age groupings, i.e. 15-44 years and 45-64 years, a sharper rise in the ratio of males to females is expected to occur even though women will continue to exceed men in substantial numbers in all age categories except the young adult grouping, where it is projected that their numerical preponderance will be considerably reduced by 1980. Among youngsters, 0-14, the only age grouping to show an excess of males, approximately the same sex ratios will be maintained throughout the projection period. Only in the age grouping 65 years and over will there be a decline in the proportions of males from 1960 to 1980.

This shift in the balance between the sexes results from a

complex interplay of several factors, most significantly: the excess of male births, the mortality differential in favor of females at all ages, improving mortality patterns for males assumed in developing the projections, and the high levels of fertility and consequent concentration of larger proportions of population in younger ages. The continuing excess of males among those under 15 years is a direct consequence of excess male births not yet much affected by higher mortality in the first fifteen years. The rise projected in proportions of males among adolescents and young adults results in part from improved male mortality, but more importantly from the "younging" of this age grouping as larger and larger cohorts enter it at the younger ages, and smaller cohorts leave it at the older ages. The increasing "maleness" of those 45-64 is due mainly to improved male survival with excess female out-migration a lesser influence.[1] This age grouping, it will be recalled, is expected to show little change in size by 1980, and will by that date be receiving successively smaller age cohorts as the depression babies grow into later middle age. The continuing decline in the sex ratio for those 65 and over will result largely from the cumulative and increasing effects of the mortality differential in favor of females Since men die earlier, the excess of women becomes cumulative with the effect that the excess in the older age levels increases as length of life (of both sexes) increases.[2]

IV. PROJECTION METHODS

Component Method

The "high" and the "low" population projections for the GBESC

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[1] .See Appendix B. In general, migration has little effect on projected sex ratios, since the male-female differential is not large in absolute numbers. Moreover, for all ages, there is excess male out-migration which would tend for most age groups to depress the sex ratio very slightly.

[2] . There is also a migration differential favoring females in this age grouping, but its effect on the sex ratio is very small. See Appendix B.

Area described in this report were developed by applying the component -- or input-output -- method of projection, generally accepted by demographers as preferable to simpler formula projections. This method not only has the advantage of producing age-sex distributions of projected future populations -- indispensible for many planning purposes -- but it is also a more reliable means of estimating total future populations, especially in a period like the present, when rapid changes in age composition are taking place.[1] The current GBESC projections started with the 1960 Census population of the Area, classified by age and sex.[2] Both projections then estimated how many in each age-sex grouping would live ten years to 1970 by applying the same set of survival rates to the numbers enumerated in 1960.[3] Each projection then subtracted from (or, in a few instances, added to) the number of survivors, an estimate of the net out- (or in-) migrants for the age-sex grouping. The "high" projection assumed a smaller total number of out-migrants; the "low" projection, a larger total number of net out-migrants. These operations provided the "high" and the "low" projection details for 1970, for those age ten years and older.

Projections for those under ten years of age was accomplished by assuming two different -- a "high" and a "low" -- fertility changes for the 1960 to 1970 period and estimating numbers of births for both fertility assumptions. Survivors to 1970 were then estimated, as were net out-migrants, to give the projected "high" and "low" figures incorporated in the 1970 projections of Table IA and Table IB.

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[1] See, for example, the several U. S. Census Bureau Projection Reports cited above.

[2] See Appendix A for a five-year age-sex distribution of the GBESC Area Population, 1960. These data were derived from published and unpublished 1960 Census tabulations available at the time the projections were being prepared.

[3] See sub-sections below for an explicit statement of the mortality fertility and migration assumptions used in making the two projections.

The process was then repeated, starting with the two sets of 1970 figures, to generate the 1980 "high" and "low" projections. As a final step in preparing Table I, age groups were combined (since larger age-groupings are more reliable than the smaller ones used in computation), and the figures rounded to the nearest thousand, to avoid a spurious precision in presenting the results. (see note to Appendix B)

Mortality Assumptions

The same series of survival rates was used for both projections. These rates are the mean of the "high" and the "low" mortality projections prepared in the Division of the Actuary, Social Security Administration, and in effect, assume a moderate, but definite, improvement in mortality experience throughout the projection period.[1] Since comparison of these rates and Massachusetts vital statistics for the 1950's showed reasonably close correspondence, they appeared to offer the best basis for a set of assumptions concerning future mortality and survival.[2]

Migration Assumptions

Two migration assumptions were made. The "high" projection assumption was that net in-or out-migration for each age-sex grouping

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[1] Rates derived from Tables 6-L, 6-H, 7-L, 7-H, 10-I, 10-II, 11-I, and 11-II, "Illustrative United States Population Projections", Actuarial Study No. 46, dated May, 1957, U. S. Dept. of Health, Education and Welfare, Social Security Administration.

[2] This is the opinion also of Dr. Jacob S. Siegel, Chief, Population Estimates and Projections Branch, Population Division, U. S. Bureau of the Census. Dr. Siegel kindly reviewed the writer's proposals for the basic methods used in developing the current projections, and made a number of very helpful suggestions, especially concerning techniques for projecting fertility, which are gratefully acknowledged. Dr. Siegel is, of course, in no way responsible for the use the writer has made of his valuable advice.

would be the same for each of the two projection decades as it has been for the 1950-1960 decade. The "low" projection assumed that net out migration would be 1.5 times as high. The 1950-1960 migration figures were derived by estimating survivors of the 1950 Census by age-group in 1960 and comparing these estimates with the number enumerated in the Area in the 1960 Census. The algebraic sum for the several age-sex groupings was then adjusted to a total net migration figure separately derived as follows: 1) The 1950 Census total was adjusted for the underenumeration of children under 5 years old which is known to have characterized that Census; 2) To this figure was added an estimate of the number of births between the Census dates, corrected for the underregistration of births; 3) From the sum was subtracted an estimate of the number of deaths in the Area between Census dates; and 4) This difference was compared with the total enumerated in 1960. To simplify and put it algebraicly, except for migration, the 1960 population should be equal to the 1950 Census plus 1950-1960 births less 1950-1960 deaths. After the adjustments noted, the 1960 enumeration was smaller by 73,446, and this figure was then assumed to be the total net out-migration for the GBESC Area between 1950 and 1960. Multiplying by 1.5 gives the total net out-migration, 110,169, assumed in the "low" projection. Specific age-sex net migration increments and decrements used in the "low" projection were derived from the original observations by adjusting to this figure as an algebraic sum.[1]

The logic of these assumptions is to anticipate that recent trends are likely to continue into the future. Since there was a small net in-migration for the decade of the 1940's[2] the rather large net out-migration of the 1950's represents an alteration of trend. Unquestionably, the availability of jobs in the GBESC Area, as compared with the labor market

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[1] See Appendix B for the migration increments and decrements used in the projections.

[2] See GBESC, Economic Base Report 2, cited above.

elsewhere, is closely related to this shift. Thus the choice of migration assumptions for population projections must take into account prospects for future expansion or contraction of local labor markets. But labor markets function in terms of supply as well as demand; and since there will be large numbers of young adults entering the labor market during the next two decades,[1] considerable expansion of job opportunities will be necessary even to hold out-migration from the Area at the levels of the 1950's, when relatively few were reaching the working ages.

The writer feels that total net out-migration is unlikely to fall below the level of the 1950's, which was therefore taken as the assumption for the "high" population projection. The assumption of out-migration at one and a half times this level for the "low" projection as a possible maximum is arbitrary, and based simply on the writer's judgment.

Fertility Assumptions

Fertility assumptions are based upon projections of crude birth rates developed by the Bureau of the Census in connection with its most recent projections of population for the United States. Starting with the average annual crude birth rate for the GBESC Area, 1957-1959, future birth rates for 1965, 1970, 1975 and 1980 were projected as ratios of the Census Bureau's national rates for these years, using two of the four sets of fertility assumptions applied by the Census Bureau in its "Illustrative Projections."[2] Fertility assumed in the "high" projection is the fertility the GBESC Area would experience if its fertility rose in the same proportion as the national fertility in Census Projection I; that is, to roughly 10% above the level of the base period, 1957-1959, and remained there during the entire projection period. Fertility assumed

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[1] See discussion of "Changing Age Composition," in Section II of this Report.

[2] The projected rates, U. S. and GBESC Area, appear in Appendix C. See also CPR Series P-25, No. 187, pp. 7ff., esp. Table F, p.10.

in the "low" projection is the fertility the Area would experience, if its fertility fell in the same proportion as the national fertility in Census Projection III; that is, to roughly the level of 1949-1951 by 1965-1970, and remained at this level to 1980. These two assumptions seem to the writer to represent probable maximum and minimum levels of fertility for the GBESC Area during the two decades of the projections. While neither is likely to be reached, the actual experience, it is thought, will probably fall somewhere between them.

Evaluation of the Assumptions

Users of these projections should evaluate the assumptions - especially the migration and fertility assumptions which are much less securely based than the mortality assumptions - carefully before applying them in their planning operations. While it is believed that the "most probable" estimate of future GBESC Area population which can be offered on the basis of present knowledge is the mean of the "high" and "low" projections of Table I, users of these figures should be constantly on the alert for new data which might indicate a definite trend of fertility or migration in the direction of either more or less rapid population growth.

APPENDIX A. 1960 POPULATION OF THE GBESC AREA BY AGE AND SEX

Ages	Male	Female	Total
0-4	189,530	182,560	372,090
5-9	166,979	160,029	327,008
10-14	150,712	144,773	295,485
15-19	120,441	123,568	244,009
20-24	99,788	104,302	204,090
25-29	102,985	103,832	206,817
30-34	111,783	115,870	227,653
35-39	114,778	121,910	236,688
40-44	108,443	117,520	225,963
45-49	100,732	111,662	212,394
50-54	92,497	104,346	196,843
55-59	82,889	94,998	177,887
60-64	72,647	88,156	160,803
65-69	61,241	78,203	139,444
70-74	45,687	62,059	107,746
75 and Over	50,440	82,183	132,623
All Ages	1,671,572	1,795,971	3,467,543

Source: 1960 U. S. Population Census Volume I, Characteristics of the Population Bulletin PC (1) 23B and Special Table PH-1 (unpublished) for Census Tracts and minor civil divisions in the GBESC Area.

APPENDIX B. ESTIMATED MIGRATION INCREMENTS AND DECREMENTS BY AGE GROUP IN THE GBESC AREA (153 TOWNS AND CITIES) 1950-1960

Note: As stated in Part IV, Projection Methods, migration increments were computed first for each age group, and then for the All Ages category. The figures for the individual age groups were then adjusted to make them total precisely to the All Ages estimate. The figures in Column 7 were also adjusted, and they add precisely to -110,169 (1.5 x -73,446). But because of this adjustment, each individual migration estimate in Column 7 is not equal to 1.5 times the corresponding figure in Column 4.

It is also important to understand that carrying the computations to the last digit gives a spurious accuracy to the table. This procedure was necessary, however, in order that the columns sum precisely to the control totals.

	Actual Experience			1.5 x Actual Experience		
Ages (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)	Total (7)
0-4	-868	-1222	-2090	-1135	-1599	-2734
5-9	-5581	-5400	-10981	-7302	-7064	-14366
10-14	-5825	-5597	-11422	-7620	-7322	-14942
15-19	-5223	3823	-1400	-6833	2077	-4756
20-24	-1017	6170	5153	-1331	3353	2022
25-29	664	-2883	-2219	361	-3772	-3411
30-34	-5281	-7123	-12404	-6910	-9320	-16230
35-39	-6788	-5212	-12000	-8881	-6819	-15700
40-44	-3684	-3445	-7129	-4820	-4508	-9328
45-49	-2512	-6389	-8901	-3286	-8359	-11645
50-54	-2250	-5250	-7500	-2944	-6869	-9813
55-59	162	-2489	-2327	88	-3257	-3169
60-64	-3331	-3801	-7132	-4358	-4973	-9331
65-69	-678	1765	1087	-887	959	72
70-74	861	3100	3961	468	1684	2152
75 and Over	217	1641	1858	118	892	1010
All Ages	-41134	-32312	-73446	-55272	-54897	-110169

Sources: U. S. Census, National Office of Vital Statistics, Massachusetts Public Document No. 1, "Vital Statistics" for 1949-1959.

APPENDIX C. PROJECTED CRUDE BIRTH RATES, UNITED STATES AND GBESC AREA

	"High" Assumption*		"Low" Assumption*	
Years	U.S.	GBESC	U.S.	GBESC
1955-1960**	25.8	22.8**	24.3	22.8**
1960-1965	26.0	23.0	22.2	20.8
1965-1970	26.7	23.6	21.8	20.5
1970-1975	28.0	24.7	23.2	21.8
1975-1980	28.9	25.5	24.0	22.5

Sources: CPR, P-25, No. 187, Table F, Massachusetts Public Document No. 1 for 1957, 1958, 1959, GBESC intercensal population estimates.

* "High" assumptions correspond to Census Bureau Series I national projections - fertility at 10% above 1955-1957 experience (1957-1959 for GBESC). "Low" assumptions correspond to Census Bureau national series III, and assume a decline from 1955-1957 experience to 1949-1951 levels by 1965, and continuance at this level to 1980.

** 1957-1959 for GBESC Area

revised 1970 population projections for the 153 cities and towns in the gbesc study area

A GBESC STAFF REPORT

A 1970 population projection for each of the 153 cities and towns in the GBESC Study Area is presented below. These projections supercede those first presented in Economic Base Report No. 4, The Population of the Cities and Towns of Greater Boston Projected to 1970, December, 1959, revised February, 1961.[1]

The present adjustment corrects for the consideration that the "most probable" 1970 population for the 153 cities and towns in the Study Area is now projected to be 3,802,500 persons, whereas GBESC's first projection estimated 3,738,000 for 149 cities and towns.[2]

The difference between these two projections is 64,500. But 32,400 of this difference is attributable to the 4 communities which have been added to the Study Area. In the revised projections presented below the remaining 32,100 people are allocated among the 149 cities and towns originally included in the Study Area.

A community by community comparison of this revision and that of February, 1961, will show that not every city and town projection has been changed. Instead a selective review was undertaken. The projection for each individual community was reexamined, first in the light of new information about factors affecting growth in that community, and second, in the light of the constructive criticisms we have received from those who have used our community projections in the past.

The individual community estimates are then based in part on a judgment factor. In view of this, and as this report will be GBESC's last in the field of population projection, it may be helpful to users of

---

[1] The February, 1961, revision was a preliminary revision which anticipated the present report. Its purpose was to correct for obvious errors, i.e. obvious in the light of the 1960 census data which had just become available. In order to make the revised estimates widely available as quickly as possible, the 1961 revisions were issued as a press release.

[2] Economic Base Report No. 2, The Population of Greater Boston Projected to 1970, June, 1959.

these data to know something of the evolution of the present estimates. To this end, the following from Economic Base Report No. 4, The Population of the Cities and Towns of Greater Boston Projected to 1970, describes the procedure used to allocate the projected 1970 total population of 3,738,000 people among the 149 cities and towns in the Study Area:

> "The 1970 population projected for the GBESC area as a whole was based on the application of the cohort-survival method to United States Census data for 1950. This technique yielded an overall figure by broad age and sex groupings. No attempt was made to apply this method to make projections by town because of the complexities of internal migration, differences among the towns in fertility rates and variations in the age-sex structure of towns.
>
> "The first step in the procedure used here to make the estimates by town was to calculate the share each city and town had of Greater Boston's total population at five-year intervals between 1925 and 1955. The trends in these shares were then examined mainly for changes in trend after 1940. A probable 1970 share for each city and town was then determined and applied to the 3,738,000 total to yield preliminary absolute population estimates by town.
>
> "These town and city estimates were then checked for reasonableness on the basis of:
>
> 1. the land available for residential development;
> 2. recent rates of residential construction;
> 3. the town's relationship to the transportation network; and
> 4. estimates of the towns' level of population.
>
> As a result of these checks, some adjustments were made to arrive at the final projections presented here.
>
> "The projections by town reflect then both simple statistical techniques and qualitative judgments. It would have been desirable to use more elaborate methods such as gravitational land use models and density models but the data necessary for these techniques was missing.
>
> "It should be noted that the town estimates are 'controlled' by the total figure, in this case, 3,738,000. The assumptions which underlie this aggregate are such that the figure falls midway between extremes of optimism and pessimism about

> future growth. It has been estimated that there is only about one chance in four that variation from this total will exceed plus or minus 4 per cent. The individual town estimates are, therefore, subject to the same degree of error.
>
> "Finally, it is important to note that these projections assume that new major highway construction, either recently completed or proposed for the coming decade, will have little effect on the growth and distribution of population in the Greater Boston Area."

When the 1960 census counts became available and were used as benchmarks, it was found that GBESC's 1960 estimate for the Study Area as a whole was off by less than one-fifth of one per cent. While this was gratifying, it was also found that trends working to redistribute the area's population among the cities and towns had been understated. In some towns which were growing, GBESC's 1960 estimate was low; in other towns which were known to be losing population, GBESC's estimate was high. It was, therefore, important to correct the 1970 estimates as quickly as possible in the light of this new information, but because GBESC's estimate of the total 1960 population was almost identical to the actual count, revising the individual city and town projections did not require that the 1970 control total be itself revised. Thus, the first revision of Economic Base Report No. 4 was based on the new census data, the additional information which GBESC's research staff had in the interval accumulated about socio-economic growth trends in the cities and towns, and the constructive criticisms of those who had used our earlier projections.

It is, therefore, worth repeating that the 1970 projections which follow are more in the nature of an adjustment of the first revision rather than a complete review. Indeed, this adjustment might well not have been undertaken except for the fact that in preparing a new projection to 1980, we also had parenthetically available a new control total for 1970 and for a slightly enlarged Study Area. With this new figure, 3,802,500, available for 1970, it seemed worth the effort to make the adjustment and thereby provide a single set of internally consistent data.

Users of these estimates should, of course, realize that they are much less secure than the projection for the larger GBESC Area, since such factors as the location of a super-highway exit, the construction of a single large factory, or a change in a zoning bylaw can have a marked effect on the population of an individual community -- especially a small one. Nevertheless, since these town and city estimates rest on a careful assessment of the presently known factors likely to influence population growth in the 1960's, it is hoped that they may prove helpful to planners and others concerned with population growth in various parts of the GBESC Area.

TABLE I. THE POPULATION OF THE 153 CITIES AND TOWNS IN THE GBESC STUDY AREA: 1950, 1960, PROJECTED 1970

City or Town	U. S. Census 1950	U. S. Census 1960	GBESC Projection 1970
Abington	7,152	10,607	15,000
Acton	3,510	7,238	12,000
Amesbury	10,851	10,787	11,000
Andover	12,437	15,878	20,000
Arlington	44,353	49,953	54,000
Ashland	3,500	7,779	13,500
Attleboro	23,809	27,118	34,000
Avon	2,666	4,301	7,000
Ayer	5,740	14,927	15,000
Bedford	5,234	10,969	18,000
Bellingham	4,100	6,774	9,500
Belmont	27,381	28,715	30,000
Berlin	1,349	1,742	2,300
Beverly	28,884	36,108	43,000
Billerica	11,101	17,867	29,000
Bolton	956	1,264	1,500
Boston	801,444	697,197	630,000
Boxborough	439	744	1,300
Boxford	926	2,010	4,000
Braintree	23,161	31,069	40,000
Bridgewater	9,512	10,276	12,000
Brockton	62,860	72,813	80,000
Brookline	57,589	54,044	51,000
Burlington	3,250	12,852	22,000
Cambridge	120,740	107,716	100,000
Canton	7,465	12,771	18,000
Carlisle	876	1,488	2,200
Chelmsford	9,407	15,130	20,000
Chelsea	38,912	33,749	28,000
Cohasset	3,731	5,840	8,000
Concord	8,623	12,517	16,000
Danvers	15,720	21,926	28,000
Dedham	18,487	23,869	26,000
Dover	1,722	2,846	4,300
Dracut	8,666	13,674	18,000

City or Town	U. S. Census 1950	U. S. Census 1960	GBESC Projection 1970
Dunstable	522	824	1,300
Duxbury	3,167	4,727	7,000
East Bridgewater	4,412	6,139	7,500
Easton	6,244	9,078	12,500
Essex	1,794	2,238	3,000
Everett	45,982	43,544	41,000
Foxborough	7,030	10,136	13,000
Framingham	28,086	44,526	62,000
Franklin	8,037	10,530	13,500
Georgetown	2,411	3,755	5,500
Gloucester	25,167	25,789	28,000
Groton	2,889	3,904	5,500
Groveland	2,340	3,297	4,000
Halifax	944	1,599	2,500
Hamilton	2,764	5,488	8,500
Hanover	3,389	5,923	8,500
Hanson	3,264	4,370	6,500
Harvard	3,983	2,563	3,600
Haverhill	47,280	46,346	45,000
Hingham	10,665	15,378	21,000
Holbrook	4,004	10,104	15,000
Holliston	3,753	6,222	8,500
Hopedale	3,479	3,987	4,500
Hopkinton	3,486	4,932	6,500
Hudson	8,211	9,666	11,500
Hull	3,379	7,055	8,500
Ipswich	6,895	8,544	10,500
Kingston	3,461	4,302	5,500
Lawrence	80,536	70,933	64,000
Lexington	17,335	27,691	38,000
Lincoln	2,427	5,613	8,000
Littleton	2,349	5,109	9,000
Lowell	97,249	92,107	89,000
Lynn	99,738	94,478	90,000
Lynnfield	3,927	8,398	15,000
Malden	59,804	57,676	55,000
Manchester	2,868	3,932	5,500
Mansfield	7,184	7,773	9,000
Marblehead	13,765	18,521	22,500
Marlborough	15,756	18,819	23,000

City or Town	U. S. Census 1950	U. S. Census 1960	GBESC Projection 1970
Marshfield	3,267	6,748	10,600
Maynard	6,978	7,695	8,000
Medfield	4,549	6,021	8,000
Medford	66,113	64,971	62,000
Medway	3,744	5,168	6,500
Melrose	26,988	29,619	31,000
Mendon	1,619	2,068	2,500
Merrimac	2,804	3,261	3,900
Methuen	24,477	28,114	32,500
Middleborough	10,164	11,065	13,000
Middleton	2,916	3,718	4,700
Milford	15,442	15,749	16,000
Millis	2,551	4,374	6,500
Milton	22,395	26,375	30,000
Nahant	2,679	3,960	4,500
Natick	19,838	28,831	36,000
Needham	16,313	25,793	32,000
Newbury	1,994	2,519	3,100
Newburyport	14,111	14,004	14,000
Newton	81,994	92,384	95,000
Norfolk	2,704	3,471	4,500
North Andover	8,485	10,908	13,500
North Attleborough	12,146	14,777	17,500
Northborough	3,122	6,687	10,000
North Reading	4,402	8,331	13,000
Norton	4,401	6,818	9,000
Norwell	2,515	5,207	9,500
Norwood	16,636	24,898	33,000
Peabody	22,645	32,202	38,000
Pembroke	2,579	4,919	8,500
Plainville	2,088	3,810	6,000
Plympton	697	821	1,000
Quincy	83,835	87,409	90,000
Randolph	9,982	18,900	25,500
Raynham	2,426	4,150	6,000
Reading	14,006	19,259	25,000
Revere	36,763	40,080	41,000
Rockland	8,960	13,119	18,000
Rockport	4,231	4,616	5,000
Rowley	1,768	2,783	3,500

City or Town	U. S. Census 1950	U. S. Census 1960	GBESC Projected 1970
Salem	41,880	39,211	36,500
Salisbury	2,695	3,154	3,600
Saugus	17,162	20,666	24,000
Scituate	5,993	11,214	18,000
Sharon	4,847	10,070	17,500
Sherborn	1,245	1,806	3,500
Somerville	102,351	94,697	88,000
Southborough	2,760	3,996	5,500
Stoneham	13,229	17,821	20,000
Stoughton	11,146	16,328	22,000
Stow	1,700	2,573	4,000
Sudbury	2,596	7,447	12,500
Swampscott	11,580	13,294	15,000
Taunton	40,109	41,132	42,000
Tewksbury	7,505	15,902	24,000
Topsfield	1,412	3,351	6,000
Tyngsborough	2,059	3,302	5,000
Upton	2,656	3,127	3,600
Wakefield	19,633	24,295	27,500
Walpole	9,109	14,068	20,500
Waltham	47,187	55,413	59,000
Watertown	37,329	39,092	40,000
Wayland	4,407	10,444	17,000
Wellesley	20,549	26,071	28,000
Wenham	1,644	2,798	4,000
Westborough	7,378	9,599	12,500
West Bridgewater	4,059	5,061	6,500
Westford	4,262	6,261	9,500
West Newbury	1,598	1,844	2,000
Weston	5,026	8,261	10,500
Westwood	5,837	10,354	15,000
Weymouth	32,690	48,177	55,000
Whitman	8,413	10,485	13,000
Wilmington	7,039	12,475	20,000
Winchester	15,509	19,376	23,500
Winthrop	19,496	20,303	21,000
Woburn	20,492	31,214	40,000
Wrentham	5,341	6,685	8,500

IGURE 1 POPULATION CHANGE, 1930 to 1950

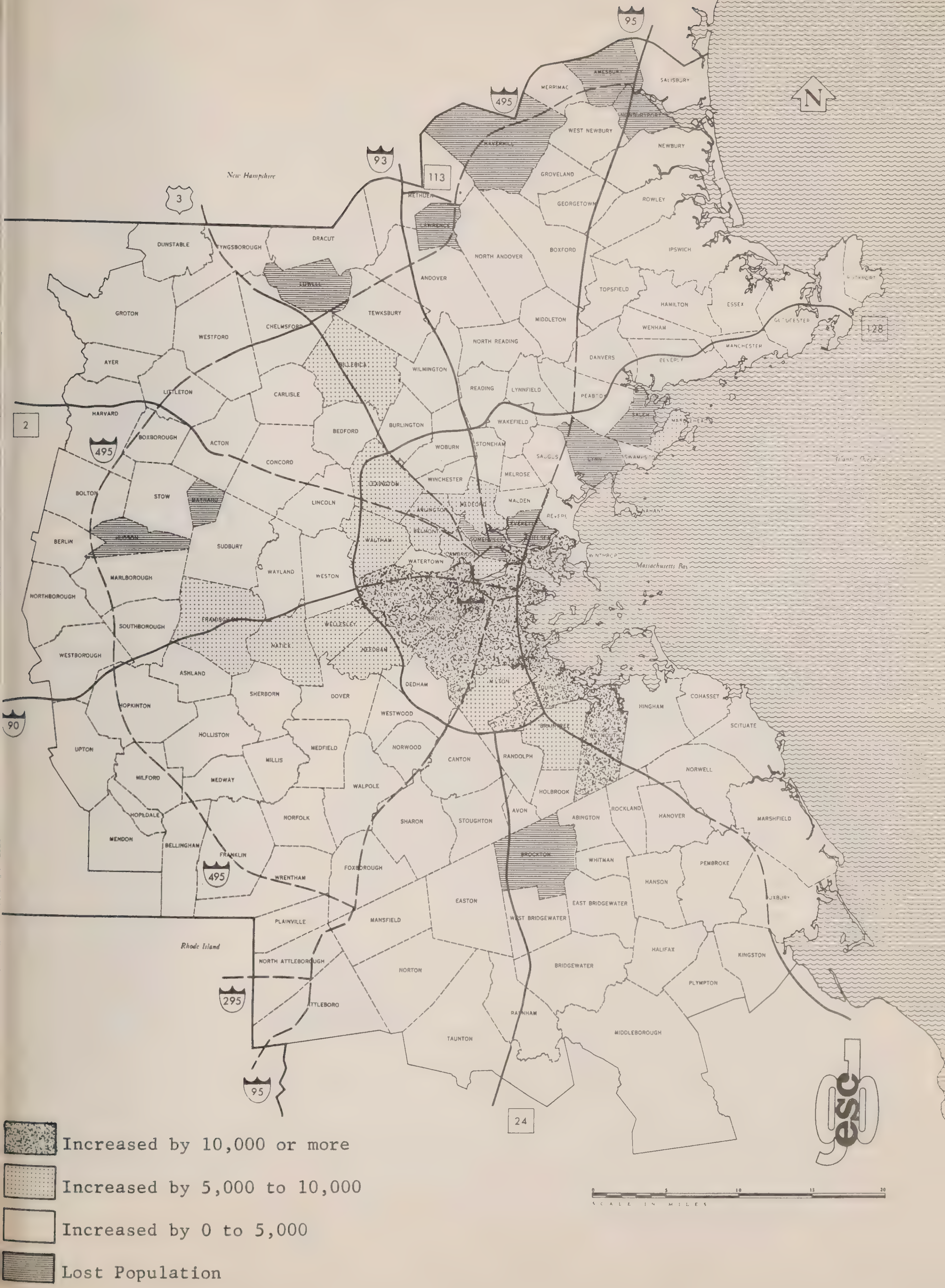
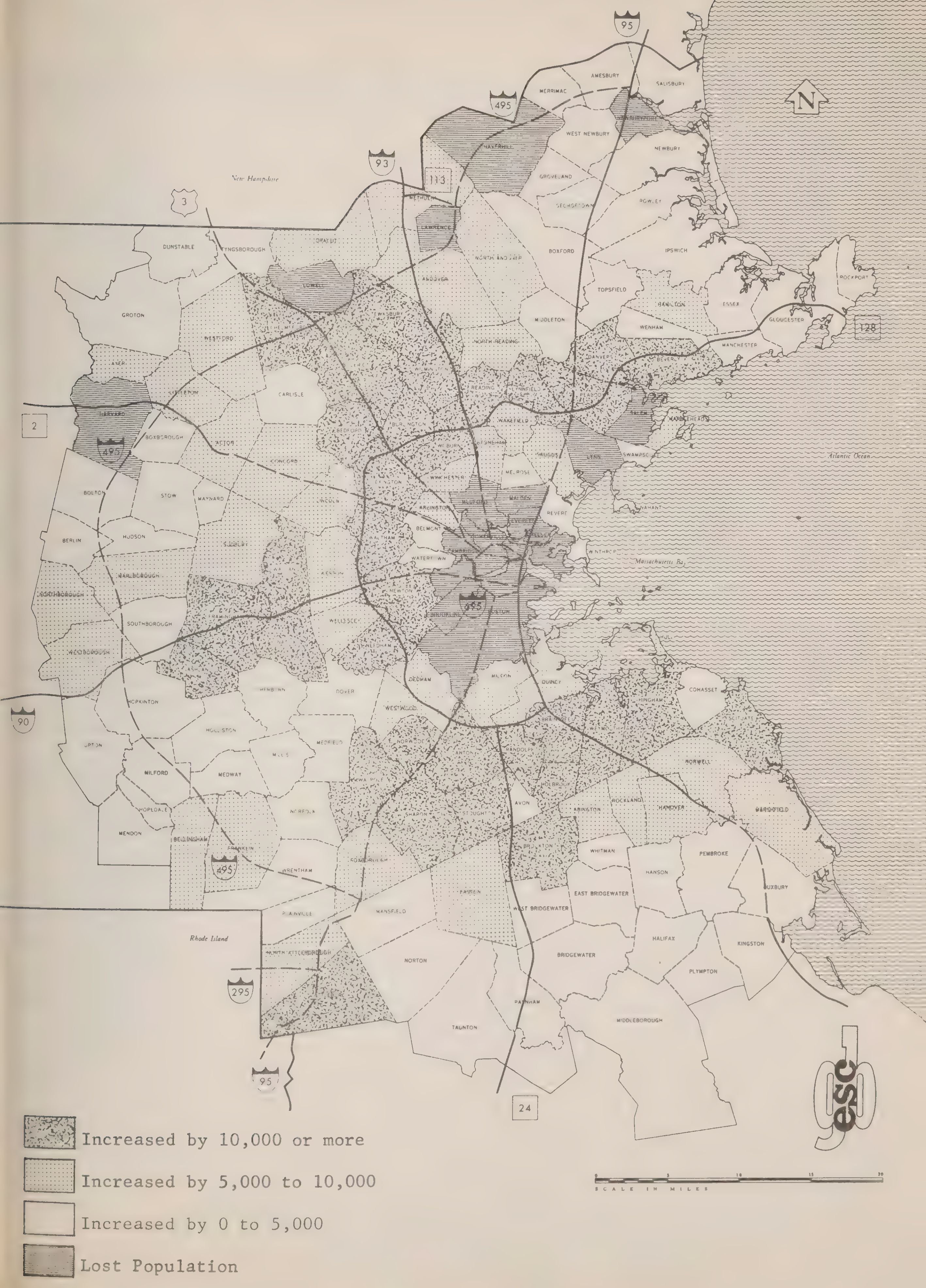


FIGURE 2 POPULATION CHANGE, 1950 to projected 1970



▨ Increased by 10,000 or more

▨ Increased by 5,000 to 10,000

☐ Increased by 0 to 5,000

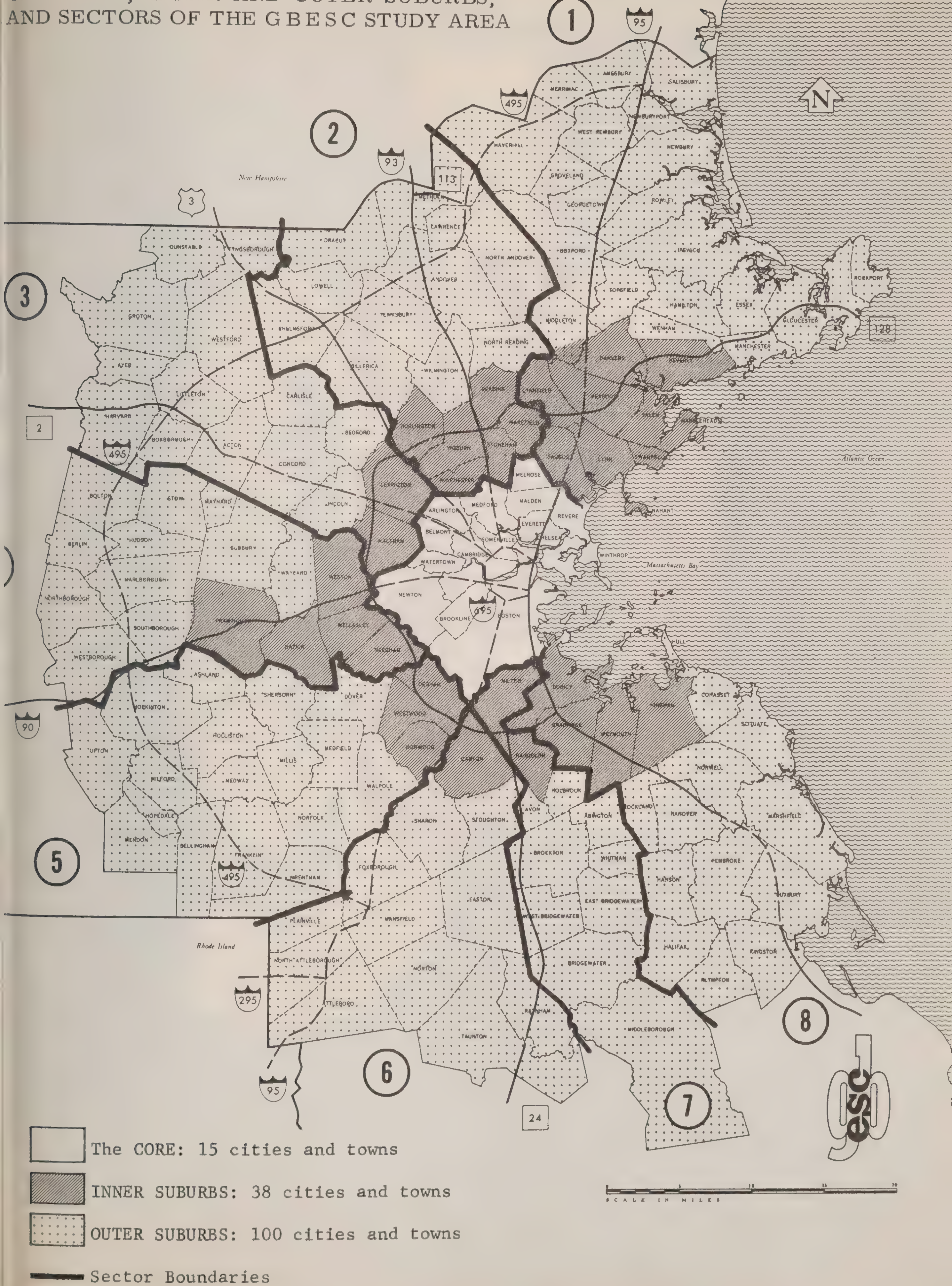
▨ Lost Population

TABLE II. THE POPULATION OF SUBAREAS OF THE GBESC STUDY AREA 1950, 1960 AND PROJECTED 1970

GBESC Subareas	Number of Cities and Towns	U.S. Census 1950	U.S. Census 1960	GBESC Projected 1970
A. The Core, Inner Suburbs, and Outer Suburbs				
The Core	15	1,567,239	1,453;740	1,367,000
Inner Band	38	732,965	936,422	1,102,000
Outer Band	100	861,575	1,077,381	1,333,500
Totals	153	3,161,779	3,467,543	3,802,500
B. The Core and Study Area Sectors				
The Core	Boston and 14 other contiguous cities	1,567,239	1,453,740	1,367.000
Sector 1	along the North Shore	396,449	442,998	491,300
Sector 2	between Routes 28 and 3	357,423	426,136	501,000
Sector 3	along Route 2	107,435	158,563	203,400
Sector 4	between Routes 20 and 9	159,765	235,307	306,900
Sector 5	between Routes 16 and 109	103,257	142,835	183,800
Sector 6	along Route 1 south	128,895	163,961	206,500
Sector 7	between Routes 18 and 28 south	145,619	186,126	224,500
Sector 8	along the South Shore	195,697	257,877	318,100

FIGURE 3

THE CORE, INNER AND OUTER SUBURBS, AND SECTORS OF THE GBESC STUDY AREA



□ The CORE: 15 cities and towns

▨ INNER SUBURBS: 38 cities and towns

⁘ OUTER SUBURBS: 100 cities and towns

━ Sector Boundaries

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economic base report 10

the electronics industry of greater boston

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200 BERKELEY STREET, BOSTON 17, MASSACHUSETTS, JULY, 1962

GREATER BOSTON ECONOMIC STUDY COMMITTEE

The Greater Boston Economic Study Committee was founded in 1957. It is a private, nonprofit, nonpolitical research organization. The Study Committee has two basic objectives:

1. To increase public understanding of the economic forces and trends at work in Greater Boston by conducting and publishing objective and basic research on the region's economy.

2. To help the Greater Boston region achieve and sustain balanced economic growth by formulating policy recommendations which may both stimulate and advise leaders in metropolitan affairs.

The Committee presently has twenty members; seventeen are businessmen, one is a newspaper editor, and two are the deans of schools of business administration. The Study Committee has a small professional research staff and a Research Advisory Committee which helps guide its research program. The Research Advisory Committee is made up of leading business economists, university professors, and professionals in the field of planning and public administration.

In 1959 the Greater Boston Economic Study Committee became an Associate Center of the Committee for Economic Development. The Study Committee believes that this association has helped to broaden and strengthen its own program and organization.

To achieve its goals, the Committee issues public policy statements, economic base reports, and regional land use analyses.

In its policy statements, the Study Committee has made recommendations aimed at solving commuting problems in the metropolitan area, stimulating economic growth in downtown Boston, and financing local government in the decade ahead.

The regional land use studies have been devoted to compiling detailed land use data for each of the 153 cities and towns in the Greater Boston region, and to projecting industrial land needs through 1980. As part of this research effort, GBESC has published a full color land use map of the Greater Boston Area.

In the economic base series population trends, the labor force, rapid transit ridership, business displacement in urban renewal areas, socio-economic patterns in growing suburban communities, and the participation of business executives in civic affairs have been analyzed. The Electronics Industry of Greater Boston presents new data based on a questionnaire survey.

PREFACE

In its Economic Base Series, the Greater Boston Economic Study Committee has published new information and data on economic characteristics and trends in the Greater Boston area. This report, the tenth in the series, deals with Greater Boston's electronics industry, the most dynamic of all growth industries in the region. Its importance to the area has been widely discussed, but despite this relatively little is known of its most important economic characteristics.

Repeatedly those concerned with the economic growth in Greater Boston have sought information about the sources of demand for the electronics products and the research and development services which are produced in this area. In particular the importance of Federal government demand has been at issue. A second set of questions has pointed to the labor supply. Here it has been asked whether or not the particular skills which are concentrated in the Greater Boston area are conducive to growth and expansion of this industry. These are not separate questions as the demand for particular electronics products gives rise to the employment of particular kinds of labor.

In this paper Professor Burtt, its author, has sought to measure the sources of demand for Greater Boston's electronics products and to relate this demand to employment. What has been developed is a set of statistical measures which not only verify but also quantify some important economic relationships for Greater Boston's electronics industry. For the first time we have some measure

of the importance of Federal government demand as against the demand of business enterprise, and the consuming public. Building on this information, Professor Burtt has suggested the labor requirements associated with the demand for different kinds of electronics products, and research and development services.

The Greater Boston Economic Study Committee believes the finding of this research will aid those seeking answers to issues of public and private policy aimed at insuring the continuing growth of the electronics industry in Greater Boston.

Finally, the Greater Boston Economic Study Committee expresses its appreciation to those firms which completed and returned our survey questionnaire and to those individuals in the electronics industry who were helpful to Professor Burtt in the development of his research design.

Ralph Kaminsky

Ralph Kaminsky
Director of Research, GBESC

TABLE OF CONTENTS

	Page
PREFACE	
INTRODUCTION	1
FACTORS AFFECTING ELECTRONICS EMPLOYMENT IN GREATER BOSTON	5
THE SIZE AND LOCATION OF REPORTING FIRMS	7
RECENT EMPLOYMENT CHANGES	11
THE IMPORTANCE OF FEDERAL GOVERNMENT DEMAND	12
SALES BY PRODUCT TYPE	14
ELECTRONICS EMPLOYMENT BY OCCUPATIONAL GROUPS	16
LABOR REQUIREMENTS BY PRODUCT TYPE	18
LABOR REQUIREMENTS PER SALES DOLLAR	21
RATES OF EMPLOYMENT GROWTH BY PRODUCT TYPES	24
SUMMARY	25
APPENDIX A. A DESCRIPTION OF THE SURVEY METHOD	
Problems of Definition	27
Adequacy of Sample	29
APPENDIX B. SELECTED ELECTRONICS INDUSTRIES FROM STANDARD INDUSTRIAL CLASSIFICATION MANUAL	30
APPENDIX C. ELECTRONICS INDUSTRY SURVEY, FEBRUARY, 1962	32

LIST OF TABLES

Page

TABLE I. EMPLOYMENT IN ELECTRONICS INDUSTRIES - SELECTED STATES 3

TABLE II. EMPLOYMENT IN ELECTRONICS INDUSTRIES - SELECTED STATES ANNUAL AVERAGES 1958 - 1960 4

TABLE III. PRESENT EMPLOYMENT OF SAMPLE FIRMS BY SUB-AREAS OF GREATER BOSTON 9

TABLE IV. PRESENT EMPLOYMENT OF ESTABLISHMENTS BY SUB-AREAS OF GREATER BOSTON 10

TABLE V. EMPLOYMENT: PRESENT AND A YEAR AGO 11

TABLE VI A. DISTRIBUTION OF SALES BY TYPE OF PURCHASER, 49 FIRMS REPORTING 13

TABLE VI B. PERCENT SALES TO THE FEDERAL GOVERNMENT BY SIZE OF FIRM 13

TABLE VII. DISTRIBUTION OF SALES BY PRODUCT CLASSIFICATION TO THE FEDERAL GOVERNMENT AND ALL OTHER USERS 14

TABLE VIII. EMPLOYMENT IN MAHOR OCCUPATION CATEGORIES CLASSIFIED BY SIZE OF FIRMS 16

TABLE IX. PRODUCTION WORKER BREAKDOWN BY SEX AND BY SIZE OF FIRM 17

TABLE X. EMPLOYMENT IN MAJOR OCCUPATION CATEGORIES, BY SELECTED PRODUCTS 19

TABLE XI. PRODUCTION WORKERS BY SEX AND SELECTED PRODUCTION SPECIALIZATION 20

TABLE XII. LABOR REQUIREMENTS PER $1,000,000 SALES BY PRODUCT CATEGORIES 22

TABLE XIII. RATE OF EMPLOYMENT CHANGE, 1961 to 1962, BY PRODUCT SPECIALIZATION 24

the electronics industry of greater boston

INTRODUCTION

Electrical machinery, the Standard Industrial Classification (SIC) in which much of the electronics industry is classified, is now the leading employer of manufacturing labor in the Boston Standard Metropolitan Statistical Area. In February 1962, 56,800 out of 293,500 workers, or one in every five employed in manufacturing, were reported in this group.[1] It has been the dramatic rise of this industry over the last decade that has offset the Post War collapse of employment in textiles, has given Boston suburbia its "new look," and has triggered an economic renaissance in all of the Greater Boston Area.

The question now is whether or not the period of rapid growth is over. Employment has leveled off at between 56,000 and 57,000, a figure below the 1960 peak of over 60,000. There is evidence that the leveling off process is not limited only to the Boston SMSA. For the Commonwealth of Massachusetts as a whole, employment in the electrical machinery industry group rose to about 100,000 in the spring of 1960, but fell to about 95,000 in the following year. It has since only partially recovered and stood at about 98,000 workers in February, 1962. Though only a part of what is popularly called electronics is in the electrical machinery industry group, and though this group also includes

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1. Preliminary data released by the Division of Statistics, Department of Labor and Industries, The Commonwealth of Massachusetts, March, 1962.

some non-electronics employment, this classification problem is not substantial enough to modify the overall indication that the rate of growth in electronics in the Greater Boston Area is slowing up.

While there is no doubt that the Greater Boston Area is a major center of electronics manufacturing in the United States and that it has proved attractive to firms from outside New England, strong centers of production have emerged in other areas as well. In fact, as shown in Table I, California ranked first in 1960 in total employment in communications equipment, and electronic components and accessories — the two major electronic industries in the electrical equipment and supplies classification — while Massachusetts ranked fifth. Furthermore, between September, 1960 and September, 1961, employment in these industries declined by 4.1 percent in Massachusetts, somewhat more than in the other leading states, although the California trend is not available. To some extent, combining these SIC classes understates the position of Massachusetts. In electronic components alone, Massachusetts ranked first in both 1958 and 1960, and as shown in Table II growth between these dates was higher in Massachusetts than in any of the other states except California.

In other branches of electronics, such as the production of computers, competition is also keen. The Boston area employed over 1,000 workers in computing machines in 1960, and had a high comparative rate of growth in this category.[1] But the Boston area was only one of

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[1] See Bureau of Employment Security, U.S. Department of Labor, Computing Machines, Industry Manpower Surveys, No. 98, January, 1961, Table 4, p. 10.

TABLE I. EMPLOYMENT IN ELECTRONICS INDUSTRIES[1] - SELECTED STATES

A. September 1960 - September 1961

State	September 1960	September 1961	Percent Change
California	113.2	N.A.	%
Illinois	70.9	68.2	-3.8
MASSACHUSETTS	60.9	58.4	-4.1
New Jersey	70.5	69.5	-1.4
New York	76.5	74.9	-2.1
Pennsylvania	51.4	53.7	4.5

B. Annual Averages 1958 and 1960

State	1958	1960	Percent Change
California	64.4	110.5	71.6%
Illinois	68.9	70.5	2.3
MASSACHUSETTS	49.5	60.5	22.2
New Jersey	64.0	70.5	10.2
New York	67.6	75.5	11.7
Pennsylvania	40.6	49.4	21.7

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1. SIC 366 (Communications Equipment) plus SIC 367 (Electronic Components and Accessories).

Source: U.S. Department of Labor, Bureau of Labor Statistics

TABLE II. EMPLOYMENT IN ELECTRONICS INDUSTRIES - SELECTED STATES
ANNUAL AVERAGES 1958 - 1960

STATE	SIC 366[1]			SIC 367[2]		
	1958	1960	% Chge.	1958	1960	% Chge.
New Jersey	41.7	46.1	10.6%	22.3	24.4	9.4%
New York	48.1	51.9	7.9	19.5	23.6	21.0
Pennsylvania	BREAKDOWN NOT AVAILABLE					
California	52.1	85.3	63.7	12.3	25.2	104.9
Illinois	50.6	50.7	0.2	18.3	19.8	8.2
MASSACHUSETTS	22.5	26.7	18.1	26.9	33.8	25.6

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1. SIC 366 (Communications Equipment); 2. SIC 267 (Electronic Components and Accessories).

Source: U.S. Department of Labor, Bureau of Labor Statistics

thirteen labor market areas which employed over 1,000 workers. And in other major sectors of the electronics group -- systems, instruments, and research laboratories -- strong competitive pressures also come from other regions of the United States.[3]

Competitive pressures in these electronics industries can be especially strong and uncertain for three basic reasons. The first is that some sections of the industry are heavily dependent on government

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[3] See "Space Crescent Transforms Gulf Area," Business Week, March 24, 1962, pp. 67ff.

contracts. Changes in the geographical placement of such contracts can be a major cause of growth in one region or of decline in another.

A second factor is the industry's high rate of product innovation. Not only has the stream of electronic innovations revolutionized other manufacturing industries; it has also created uncertainties within the electronics industry itself. Certain electronic products, geared for mass production, may suddenly be made technologically obsolete. This kind of innovation is of course also a source of new production and employment. But it also means that Greater Boston's electronics industry which concentrates heavily in research and development, has a built-in source of continuing economic instability and this itself can be disruptive of orderly expansion in the industry at any particular location.

A third factor is the merger or consolidation of firms. Mergers can create uncertainties about industrial location, as new management may differ from the old in its evaluation of the advantages of specific plants, sites, and production possibilities.

Factors Affecting Electronics Employment in Greater Boston

Although it is impossible to predict the future employment trends of electronics in Greater Boston, it is desirable to identify and measure certain characteristics of the industry relevant to its growth. Unfortunately there are few overall economic analyses of the industry. This is explained in part by the short period of time in which electronics has displayed its capacity for growth so that few benchmarks

are available. It is also explained by the difficulty in classification of the seemingly endless and constantly changing array of different products.

What are the characteristics of the Greater Boston electronics industry? In terms of buyers of its products, how much employment is dependent upon government contracts, upon final consumer demands, or upon investment outlays of business firms? What types of products does the industry produce? Are they especially subject to technological obsolescence? Answers to these questions could give some indication of the types of problems with which the Greater Boston industry is faced.

Also relevant to the locational advantages of the area are the types of labor required to produce various products. Is it true that Greater Boston's supplies of professional and scientific personnel are a prime factor in the growth of all branches of the electronics industry, or is it only in certain types of electronic production that such labor is relevant?

In order to explore these relationships it was necessary to gather new data by a survey of electronics firms in the Greater Boston Area. The questionnaire, the size and character of the sample, problems of product definition, and the system of classifying the sources of product demand are discussed in Appendix A. The basic information which was sought however related to:

1. The size and location of firms and establishments;

2. the value of sales;
3. the distribution of sales by type of buyer and product;
4. employment by occupational category and company division where possible.

The Size and Location of Reporting Firms

Of the 205 firms to whom the questionnaire was sent, the responses of 55 or about 27 percent were usable in whole or in part. Fifty-four firms reported current employment totalling 29,461, for an average of 546 per firm. It is estimated that the total employment reported is about one-fourth of all electronics industry employment in the Greater Boston Area.

Sales for the fiscal year 1961 of about $280,000,000 were reported by 49 firms, for an average of $5,730,000 per firm. The share these sales are of total sales by Greater Boston firms cannot be estimated as adequate benchmarks are not available.[1]

Firms identified their location with respect to the three sub-areas of Greater Boston. As shown in Figure I these were the Core which included Boston and 12 contiguous cities and towns; the Inner Band a group of cities and towns, including the Route 128 communities, which

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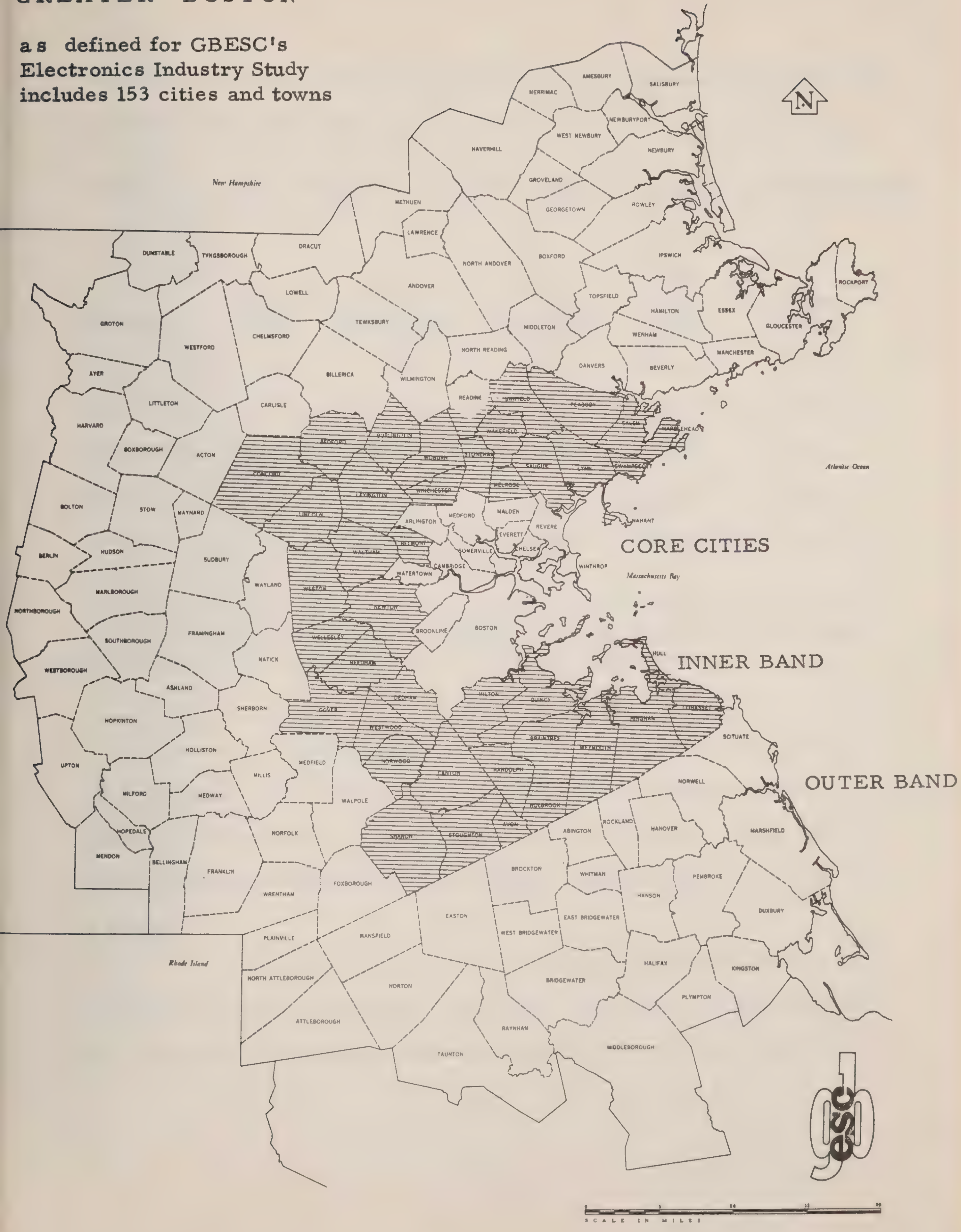
[1] To illustrate, Raytheon Manufacturing Company, which is the leading producer in the field, was not included among the respondents. In 1961 this firm had employment of about 40,000, most of which was in the Greater Boston area, and total sales of more than $500,000,000.

GREATER BOSTON

as defined for GBESC's Electronics Industry Study includes 153 cities and towns



form an arc around the Core; and the Outer Band, the remaining cities and towns in GBESC study area.

TABLE III. PRESENT EMPLOYMENT OF SAMPLE FIRMS BY SUB-AREAS OF GREATER BOSTON

Sub-Area	No. of Firms	Total Employment	Average Employment	Total Sales (000's)	Average (000's)
Core Cities	16	2,352	147	$25,611(1)	$1,707
Inner Band	21	13,399	670(2)	98,516(3)	5,795
Outer Band	10	1,542	154	16,350	1,635
Other(4)	8	12,168	1,521	140,310(5)	20,044
Total	55	29,461(6)	546(6)	280,787(7)	5,730(7)

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1) 15 firms reporting; 2) 20 firms reporting; 3) 17 firms reporting; 4) multi-establishment firms located in 2 or more sub-areas; 5) 7 firms reporting; 6) 54 firms reporting; 7) 49 firms reporting.

Of the 55 firms reporting, 16 were located in the Core, 21 in the Inner Band, 10 in the Outer Band, while the other 8 firms reported plants located in more than one of the sub-areas. These last eight were larger than average in employment and had over 1,500 workers a piece.

As was to be expected most of the employment reported was concentrated in a relatively few firms. The largest fourteen firms each employing 500 or more workers accounted for 83 percent of all

workers in the sample. Sixteen middle-sized firms employing between 100 and 499 workers accounted for an additional 13 percent while the 23 smallest firms, each employing fewer than 100 workers, had only 4 percent of the total employment.

The distribution of sales reflected the same concentration in a small number of firms. Though the average sales for 49 firms was $5,730,000 for 1961, only 12 of the firms had sales in excess of that figure.

TABLE IV. PRESENT EMPLOYMENT OF ESTABLISHMENTS BY SUB-AREAS OF GREATER BOSTON

Sub-Area	Number of Establishments	Total Employment	Average Employment	Percent Distribution of Employment
Core Cities	25	6,927	277	23.5%
Inner Band	41	16,737	408	56.8
Outer Band	21	5,797	276	19.7
Total	87	29,461	339	100.0

The 54 firms reporting employment had a total of 87 establishments in the Greater Boston area. As shown in Table IV, nearly one-half of these plants were in the Inner Band and Employed over half, 56.8%, of the workers. Twenty-five establishments in the Core employed 23.5 percent of the sample, and 21 plants in the Outer Band employed the remaining 19.7 percent.

The average size of plant was 339 workers. A comparison

of sub-areas, however, showed that the Core and Outer areas had the smaller-sized plants averaging about 275 workers, while in the Inner Band, or Route 128 area, firms reported an average size of 408.

Recent Employment Changes

The sample firms added 5,400 workers during the preceding twelve-month period for a rate of employment change of 22.6 percent. Over half of the net increase was in firms located exclusively in the Inner Band, that is not counting the Inner Band employment of firms also reporting employment elsewhere. But the highest rate of employment growth was found among firms in the Outer Band of communities.

TABLE V. EMPLOYMENT: PRESENT AND A YEAR AGO

A. By Sub-Area

Sub-Area	Present Employment	Year Ago Employment	Net Change	Percent Change
Core Cities	2,352	1,947	405	20.8%
Inner Band	13,399	10,280	3,119	30.3
Outer Band	1,542	1,008	534	53.0
Other (1)	12,168	10,791	1,377	12.8
Total	29,461 (2)	24,026	5,435	22.6%

B. By Size of Firm

Size Class by Workers	No. of Firms	Employment		Change	
		Present	Year Ago	Amount	%
1-99	24	1,174	879	295	33.6%
100-499	16	3,944	3,052	892	29.2
500 and up	14	24,343	20,095	4,248	21.1
Total	54	29,461	24,026	5,435	22.6

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1) In more than one sub-area; 2) 54 firms reporting.

Employment changes over the preceding twelve-month period broken down by size of firm show that on the average the smaller the firm the larger its growth rate. Firms employing fewer than 100 workers had the highest rate of 33.6 percent. The middle size group reported an average growth of 29.2 percent. while those employing 500 or more had the lowest rate of 21.1 percent. Nonetheless, it was the largest fourteen firms that accounted for most, 70 percent, of all new jobs.

The Importance of Federal Government Demand

The study revealed the dominance of the federal government as the purchaser of the products and services of Greater Boston electronic firms. Demands from business firms were secondary, while households as final users of products were of minor significance.

The questionnaire specifically asked firms to estimate the distribution of their sales by final users, wholesalers, prime contractors, and other intermediaries, were to be excluded. Almost one-half of all sales, 48.7 percent, went either directly or indirectly via resale to the Federal government, 33.2 percent went to business firms which retained the products as part of their capital equipment. Only 11.9 percent of the output went to households or other private consumers while 5.8 percent was sold to state and local governments.

TABLE VI A. DISTRIBUTION OF SALES BY TYPE OF PURCHASER, 49 FIRMS REPORTING

	Sales (000's)	Percent
Federal Government	$136,629	48.7%
Business Firms	93,231	33.2
Households	33,484	11.9
State and Local Governments	16,335	5.8
Unreported	1,108	.4
Total	$280,787	100.0%

TABLE VI B. PERCENT SALES TO THE FEDERAL GOVERNMENT BY SIZE OF FIRM

Size of Firm in Employees	Firms Reporting	Sales to Federal Government 0-50%	51-100%
1-99	23	9	14
100-499	16	2	14
500 and over	14	7	7
Total	53	18	35

With respect to sales to the Federal government only 3 of the 55 responding firms reported no sales either directly or indirectly. Another 16 firms had sales to the Federal government of 50 percent or less. But the remaining 35 firms (two-thirds of the entire group) sold 51 percent or more of their output either directly or indirectly, to the Federal government, and fourteen of these firms had 90 percent or more of their sales going to this purchaser.

By size of firm, it was the middle-sized firm of 100 to 499 workers that was most dependent upon Federal government sales. The smallest firms were next in terms of such dependency, while the largest firms were least dependent.

Sales by Product Type

Sales to the Federal government were broken down into two broad classes - product sales and sales of research and development services (R & D).[1] Products totaled almost $100,000,000 and accounted for over 70% of the total Federal government sales. R & D sales totaled nearly $40,000,000 about 30% . Twenty-nine firms reported selling such services, however, and in a small but significant number of firms R and D comprised over 90 and in some cases 100 percent of the firm's total sales to the Federal government.

TABLE VII. DISTRIBUTION OF SALES BY PRODUCT CLASSIFICATION TO THE FEDERAL GOVERNMENT AND ALL OTHER USERS

(sales are in 000's)

Federal Government		
Product	$97,707	
R & D	39,922	$136,629
All Other Users		
Components	$38,533	
Instruments	20,377	
Other	84,455	143,365
Buyer not Reported		793
Total		$253,360

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[1] R & D includes development of models, new techniques, and reports of specialized research.

The product breakdown of sales to all other buyers indicates the difficulty of giving a satisfactory representation of the different sub-industry groups within the general field. Since output under government contract was not specified by type of commodity, data of private sales does not necessarily give a true picture of product-mix. Nonetheless, the breakdown does indicate what buyers, other than the Federal government, purchased from these firms during the 1961 fiscal year. Over one-fourth of this demand was for electronic components, a one-sixth for instruments, and the remainder on electronic systems, computers, and other products. The last category could not be broken down more specifically for two reasons: the lack of detailed product information and the necessity of avoiding disclosure of information which would identify the reporting firm.

The reported degree of specialization within the five-fold classification -- components, instruments, systems, computers, and R & D -- was striking. Of the 50 firms for which this information was available, 21 reported 90 percent or more on their production was accounted for by one product classification, 15 firms by two classifications, and 6 by three classifications. Only 8 firms reported four or five classes as being well represented in their total production. Thus only about one quarter of all reporting firms could be considered well diversified in terms of these product categories.

Electronics Employment by Occupational Groups

Production workers were the largest group and accounted for 47.5 percent of total employment. The sample showed that there is an approximately equal number of males and females among production workers, but the ratio of females, rises as the size of firm increases. For the smallest firms, the ratio is almost two male workers to one female, while for the largest firms the percentage of females is 52.3.

TABLE VIII. EMPLOYMENT IN MAJOR OCCUPATION CATEGORIES CLASSIFIED BY SIZE OF FIRMS

Occupational Categories	All Firms	Firm Size 1-99	100-499	500 and over
	A. Number of Employees			
Production Workers	13,700	599	2,175	10,926
Electronic Technicians	1,906	156	270	1,480
Scientific and Professional Personnel	5,212	235	559	4,418
Women Office Workers	2,792	96	401	2,295
Others	5,251	88	539	4,624
Total	28,861	1,174	3,944	23,743
	B. Percent Distribution of Employees			
Production Workers	47.5%	51.0%	55.1%	46.0%
Electronic Technicians	6.6	13.3	6.8	6.2
Scientific and Professional Personnel	18.1	20.0	14.2	18.6
Women Office Workers	9.6	8.2	10.2	9.7
Others	18.2	7.5	13.7	19.5
Total	100.0	100.0	100.0	100.0

The labor force of the reporting firms is also heavily weighted with scientific and professional personnel. Of the 28,861 workers reported by 53 reporting firms, over 5,000 or 18.1 percent, were classified in this highly educated occupational group.

Labor requirements by occupational groups varied with the size of the firm. The relative number of production workers was highest (55.1 percent) in middle-sized firms of 100 to 499 workers and lowest (46.0 percent) in the largest firms.

The ratio of electronic technicians was 13.3 percent in the smallest firms but only 6.2 percent in the largest. On the other hand, the relative number of women office workers increased from 7.5 percent in the smallest firms to over 10 percent in the medium-sized firms and 9.7 in the largest. Similarly, the category of "other workers," which included such varied groups as administrative, sales, maintenance, machine shops, and custodial, became relatively more important with the increasing size of firms.

TABLE IX. PRODUCTION WORKER BREADKOWN BY SEX AND BY SIZE OF FIRM

A. Number of Workers

Size of Firm	Male	Female	Total
1-99	372	227	599
100-499	1125	1050	2175
500 and over	5213	5713	10926
Totals	6710	6990	13700

B. Percent Distribution

Size of Firm	Male	Female	Total
1-99	62.1%	37.9%	100.0%
100-499	51.7	48.3	100.0
500 and over	47.7	52.3	100.0
Totals	49.0	51.0	100.0

The firms with 500 or more workers reporting an occupational breakdown had 82.3 percent of all workers in the sample. They had however a somewhat higher share of "other workers", 90.6 percent, scientific and professional personnel, 89.5 percent, and women office workers, 84.6 percent, and less than average shares of production workers, 79.3 percent, and of electronic technicians, 78.3 percent.

Labor Requirements by Product Type

In this section, we compare labor requirements associated with selected major products. Sufficient information is available for a comparison among three types of products: (a) research and development, (b) electronic components, and (c) instruments.

In research and development, eight firms were clearly identified and in no case was the firm's sales of R and D services less than 50 percent of its total sales. All tolled these firms employed 10,581 workers.

The breadkown of labor requirements by major occupational categories for these R and D firms revealed a low proportion, 23.2 percent, of production workers and a relatively high proportion, 29.0 percent, of scientific and professional personnel. The ratio of electronic technicians and of "other workers" was also above the average of the sample. For production workers, the breakdown of male and female workers revealed a much higher proportion of male workers, 77.9 percent, than was found in the total sample, i.e., 49.0 percent.

TABLE X. EMPLOYMENT IN MAJOR OCCUPATION CATEGORIES, BY SELECTED PRODUCTS

Occupational Categories	All Firms (1)	Research and Development (2)	Electronic Components (3)	Instruments (4)
	A. Number of Employees			
Production Workers	13,700	2,450	5,301	550
Electronic Technicians	1,906	1,005	195	207
Scientific and Professional Personnel	5,212	3,067	323	715
Women Office Workers	2,792	1,208	333	353
Others	5,251	2,851	451	180
Total	28,861	10,581	6,603	2,005
	B. Percent Distribution of Employment			
Production Workers	47.5%	23.2%	80.3%	27.4%
Electronic Technicians	6.6	9.5	3.0	10.3
Scientific and Professional Personnel	18.1	29.0	4.8	35.7
Women Office Workers	9.6	11.4	5.0	17.6
Others	18.2	26.9	6.9	9.0
Total	100.0	100.0	100.0	100.0

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1) 49 firms reporting; 2) 8 firms reporting; 3) 14 firms reporting; 4) 9 firms reporting.

In electronic components, 15 firms employing 6,603 workers were identified. In these firms 80 percent or more of their non-federal government production was on components. Even though a few of the 15 firms had a high proportion of their output for government contracts, it was a reasonable assumption that components characterized their total production.

The labor requirements of these firms were substantially different than the R and D firms. Four out of five of their employees, 80.3 percent, were production workers and of these 68.7 percent were women. The proportion of the labor force in the categories of electronic technicians and scientific personnel was small, 3.0 and 4.8 percent respectively. The proportion of women office workers and "other workers" was also low.

TABLE XI. PRODUCTION WORKERS BY SEX AND SELECTED PRODUCTION SPECIALIZATION

Product Specialization	Number of Employees			% of Distribution		
	Total	Male	Female	Total	Male	Female
Research and Development	2450	1908	542	100.0%	77.9%	22.1%
Electronic Components	5301	1658	3643	100.0	31.3	68.7
Instruments	550	432	118	100.0	78.5	21.5

In the third product type, instruments, nine firms with a total employment of 2,005 workers reported 85 percent or more of their output in this category. Although a few had a high proportion

of government contracts, again it was reasonable to assume that their major productive effort was in the instruments field.

The labor requirements of these instrument firms revealed a pattern somewhat similar to firms primarily in research and development. Production workers were a relatively small proportion of total employment, 27.4 percent, and of these a somewhat higher percentage were men, 78.5 percent, than was the case in the firms in research and development. A high percentage of scientific and professional workers, 35.7 percent, and a high percentage of woment office workers, 17.6 percent, were employed. In contrast, "other" workers accounted for a lower proportion, 9.0 percent, than they did in the case of research and development. As might be expected the instrument firms reported the highest percentage of electronic technicians, 10.3 percent.

Labor Requirements per Sales Dollar

In questions 4, 5 and 7 (see Appendix C) each firm was asked to report the distribution of its sales by buyer and product type. In question 8, employment by occupational category, and in question 9, the value of sales were reported. Using these data it was possible to construct a table, Table XII, showing labor requirements by occupational category per sales dollar of each product.

Forty-seven firms with a total employment of about 18,000 workers and total sales of $216,120,000 returned questionnaires which contained sufficient information to carry out the estimating procedures.

TABLE XII. LABOR REQUIREMENTS PER $1,000.000 SALES BY PRODUCT CATEGORIES

	Federal Government		Private Sector		
	Electronic Products	Res. & Develop.	Components	Instruments	All Other
Total Labor Requirements	79.3	94.5	86.6	71.3	84.8
Production Workers	42.1	37.7	64.4	22.4	35.8
Male	22.3	31.7	24.7	14.9	26.6
Female	19.8	6.0	39.7	7.5	9.2
Electronic Technicians	4.6	11.2	3.2	5.9	6.3
Electronic Engineers	4.5	7.1	2.1	5.4	4.0
Other Professional and Scientific	6.7	14.5	3.2	10.1	9.6
Women Office Workers	7.2	10.2	4.8	9.1	7.8
Other	14.2	13.8	8.9	18.4	21.3

The method may be summarized as follows. For each firm the employment reported in each occupation was allocated among its products according to its reported distribution of production sales. Thus, to illustrate, it was estimated that firm A had, say, 150 electronic technicians engaged in the production of instruments. Similar estimates were computed for each firm,, its products and its employment. By summing appropriately, it was possible to estimate the total employment of each kind devoted to each of the major products. But the value of these products could be inferred from questions 4, 5, 7 and 9. By dividing

this estimated value of sales for each product into the number of workers estimated to be producing them, an estimate of employment in each occupational group per dollar of sales for each product was derived.

These estimates are presented in Table XII and as shown, labor requirements by occupational category are presented for five major product breakdowns. Of these, the first two are product, and research and development sales to the Federal government; the remaining three, sales of components, instruments and "all other" are sales to the private sector.

As shown, on a "per million dollars of sales" basis, research and development has the highest labor requirement, 94.5 workers. It is followed by components with, 86.6. Instruments require 71.3 workers, or nearly a third less than R and D. "All other" sales to the private sector require about the same number of workers as components. The labor requirement of 79.3 workers for a million dollars of sales of products to the Federal government is in contrast relatively low.

The number of workers by occupational category per million dollars of sales reflects the striking differences between types of products. For example, one million dollars of sales in components is associated with 64.4 production workers as against only 22.4 for instrument sales. In terms of women production workers, the variation is even greater: only 6 would be hired per million dollars of R and D sales as compared with nearly 40 for the same amount of sales of electronic components.

R & D uses more engineering and professional personnel and electronic technicians than any other product category, although instruments rank high in their requirements, few professional and scientific personnel are engaged.

Rates of Employment Growth by Product Types

It has been pointed out in numerous discussions of the electronics industry of Greater Boston that the strength of the area lies in its scientific and professional labor supplies and in its skilled labor force, especially its supply of electronic technicians as well as machine tool and other skilled operators. This study generally supports that conclusion. It is highly relevant to the questions raised in the introduction to this Economic Base Study that R & D firms reported the highest rate of employment gain over the one year period from 1961-1962. Employment in these firms rose 38.6 percent in comparison with the overall gain of 22.4 percent.

TABLE XIII. RATE OF EMPLOYMENT CHANGE, 1961 to 1962, BY PRODUCT SPECIALIZATION

	Employment Change	
	Amount	Percent
All Firms	5285	22.4
Research and Development	2947	38.6
Components	1338	25.4
Instruments	157	8.5
All Other	843	9.5

Of the 5,285 added jobs, R and D firms accounted for 2,947, or over 55.8 percent. These data support the view that the availability of scientific, professional and technical supplies of labor in the Greater Boston Area, on which R and D depends so heavily, has been a major source of regional strength.

The 15 firms in electronic components also had a somewhat higher than average growth rate during the year, 25.4 percent, and added one-quarter of all of the new jobs among the firms reporting. It is important to recall that these firms require the greatest relative amount of production labor, and in particular a high percentage of women workers.

In the instrument field, the nine firms reporting had the lowest rate of expansion, 8.5 percent, and for the "all other" firms in the sample, the rate of employment growth was also low, 9.5 percent.

Summary

On balance over the past year, it seems clear that the changes in the electronics industry have definitely favored the research-oriented firm, and that the expansion that has occurred has more than proportionately benefited scientific personnel. It is also clear that the government has been a major factor in the relatively high rate of employment for the industry generally. In the firm analysis, the Federal government was the principal buyer of research and development, accounting for some 71.7 percent of the total sales of those companies. For producers of components, the Federal government purchased about one-

half, 49.1 percent, of their output. In instruments, Federal government purchases were a little more than half, 54.9 percent, of their total sales. For firms, whose products were classified as "all other", the Federal government purchases represented the smallest fraction, 42.9 percent, of their total sales. Except in the case of the instrument manufacturers, there seems to have been a clear relationship between Federal government purchases and the rate of employment expansion: the larger the share purchased by the Federal government, the greater the rate of employment growth.

The question of the ability of the Greater Boston electronics industry to continue to expand in the future as it has in the past cannot, of course, be answered by any one survey or analysis. This survey confirms the high degree of dependence of the industry on government contracts and, therefore, the element of uncertainty that such dependence brings.

At the same time, the study indicates the strength of the industry of Greater Boston in its highly trained labor supplies, especially electronic technicians and scientific and professional personnel. The analysis of the responses indicates that those branches of the industry that rely heavily on such labor have enjoyed the highest rate of growth. Those supplies have attracted firms and government contracts here in the past; they should also do so in the future.

Finally, it is the growth of firms in research and development that is the best guarantee against competition from technological obsolescence within the industry. Indeed, the creation of technological obsolescence is their business.

APPENDIX A. A DESCRIPTION OF THE SURVEY METHOD

Problems of Definition

Collecting information of the type used in this study raised three problems of definition. First, the fundamental question of what is an electronics firm has never satisfactorily been answered. Under the present Standard Industrial Classification System (see Appendix B), the firms most commonly included are classified in the industry groups of electrical machinery, non-electrical machinery (e.g. computers), instruments ordinance and in the non-manufacturing category of business services not elsewhere classified. Although several governmental and private preliminary studies of what constitues the industry and its products have already been made, no final agreement has been reached.

The second problem pertains to the adequacy of the measurement of output of research-oriented firms. Where research and development services are sold, value is readily computed; but where it is "produced" for the firm itself, value would have to be based on cost rather than market price.

The third problem arises in the classification of products and users. It is very difficult to obtain a satisfactory yet simple two-way classification system for the tremendous variety of products in the electronics industry. For example, one survey of the industry used the following breakdown based in large part on a combination of products and users:

a. radio and television sets (final consumer)

b. measurement devices (industrial)

c. military electronics (government)

d. electronic parts and supplies (mixture)

This classification was later rejected by the agency that used it on the grounds that the fourth category was too heterogeneous.

The questionnaire that was mailed to firms was developed after a series of visits with companies concerned with different types of electronic products. The greatest problem was the proper system of product classification. The system that was finally used had to strike a balance between greater and lesser detail. In retrospect it seems that the "other products" category was somewhat larger than desirable, but because of the nature of the industry, this was difficult to avoid.

For the present study, the universe of firms was obtained largely from two current directories[1] by identification of specific firms through product classifications relevant to the broad definition of electronics used here. This method of determining the universe probably leads to inclusion within the universe of a few firms which normally would not be classified as electronic in character. It was judged however that such firms would probably not answer the questionnaire.

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[1] Directory of Manufacturers in Greater Boston, 1960-1961 edition, Greater Boston Chamber of Commerce, Boston, n.d., and the Directory of New England Manufacturers, 1962, 26th Annual Edition, Issued with the Editorial Cooperation of The New England Council (Boston, George D. Hall Company), 1961.

Some questionnaires were returned with notations to the effect that they were not "electronics" firms.

Adequacy of Sample

The adequacy of the responses to the questionnaire is difficult to judge in view of the lack of up-to-date benchmarks for the Greater Boston electronics industry. For example current statistics on the total employment within the specific three and four digit industries of the SIC code, which we have considered as the electronics industry, are not available for the Greater Boston area as defined by the Greater Boston Economic Study Committee. Thus it is difficult to estimate the extent to which the responses reflect either the industry as a whole, or important subdivisions of the industry. Also the sample may not truly state the rate of employment change for the entire industry, because all large firms in the area are not included. A change in employment within any one large firm could influence the industry's rate of employment change, while a similar change in a small firm would have little if any influence on the total.

Nevertheless, the response of over 27 percent was a respectable one. And if the information gathered is used with due regard to considerations of the kind first noted, it may be assumed that the results furnish an adequate basis for the comparisons which were made among firms producing different types of output. Especially significant in this connection, is the sharp differentiation in the labor requirements by broad types of products.

APPENDIX B. SELECTED ELECTRONICS INDUSTRIES FROM STANDARD INDUSTRIAL CLASSIFICATION MANUAL

prepared by
The Technical Committee on Industrial Classification
Office of Statistical Standards, 1957

Industry Numbers			
19			ORDNANCE AND ACCESSORIES
	194		Sighting and Fire Control Equipment
		1941	Sighting and Fire Control Equipment
35			MACHINERY, EXCEPT ELECTRICAL
	357		Office, Computing, and Accounting Machines
		3571	Computing and accounting machines, including cash registers.
36			ELECTRICAL MACHINERY, EQUIPMENT, AND SUPPLIES
	365		Radio and Television Receiving Sets, Except Communication types.
		3651	Radio and television receiving sets, except communication types.
	366		Communication Equipment.
		3661	Telephone and telegraph apparatus.
		3662	Radio and television transmitting, signaling, and detection equipment and apparatus.

	367	Electronic Components and Accessories.
	3671	Radio and television receiving type electron tubes, except cathode ray.
	3672	Cathode ray picture tubes.
	3673	Transmitting, industrial, and special purpose electron tubes.
	3679	Electronic components and accessories, not elsewhere classified.
38		PROFESSIONAL, SCIENTIFIC, AND CONTROLLING INSTRUMENTS: PHOTOGRAPHIC AND OPTICAL GOODS: WATCHES AND CLOCKS.
	381	Engineering, Laboratory, and Scientific and Research Instruments and Associated Equipment.
	3811	Engineering, laboratory, and scientific and research instruments and associated equipment.
	382	Instruments for Measuring, Controlling, and Indicating Physical Characteristics.
	3822	Automatic temperature controls.
73		MISCELLANEOUS BUSINESS SERVICES
	739	Business Services, Not Eleewhere Classified.
	7391	Research, development, and testing laboratories.

APPENDIX C. ELECTRONICS INDUSTRY SURVEY, FEBRUARY 1962

You may find it helpful to read through the questionnaire before you begin answering it.

1. How many establishments does your firm have in Greater Boston (see map).

(SEE TEXT PAGE 9)

Number of Establishments	GBESC Study Area (see enclosed map)
1________	In the core cities
2________	In the inner band
3________	In the outer cities
4________	Total Establishments in Greater Boston

2. On a percentage basis, distribute total employment in your Greater Boston establishments as follows:

Percent of Total Employment	GBESC Study Area
1________	In the core cities
2________	In the inner band
3________	In the outer cities
100%	

3. When did your last fiscal year end? ____________, __________, 1961
(month) (day)

4. Allocate the sales of all your Greater Boston establishments made during your last fiscal year on a percentage basis as follows:

% Sales	Final Destination of Sales
1________	Directly or Indirectly* to the Federal Government
2________	All Other Users
100%	

* "Indirectly to the Federal Government" refers to resales of your products by wholesalers, prime contractors, etc., to the Federal Government.

5. Allocate the sales your firm makes directly or indirectly to the Federal Government (i.e. those referred to in Question 4, No. 1) on a percentage basis as follows:

Sales Going Directly
or Indirectly to the
Federal Government

1 ________ Product Sales
2 ________ Sales of Research and Development Services

100%

6. On a percentage basis, estimate who the final users were of those sales your Greater Boston firms make which did not go either directly or indirectly to the Federal Government (Question 4, No. 2).

To clarify: Wholesalers and/or prime contractors are not final users. They resell your products to one of the three final users listed below.

If you sell wholly or partly through wholesalers and/or prime contractors, estimate their pattern of resale of your products.

Final User of Sales Which did not
go Directly or Indirectly to the
Federal Government

1 ________ State and Local Governments
2 ________ Householders and/or Other Private Consumers
3 ________ Business Firms who Retain Your Products as Part of their Capital Equipment

100%

7. On a percentage basis, describe the composition of your sales which did not go directly or indirectly to the Federal Government (These are the same sales reported in Question 4, No. 2 and Question 6).

1 ________ Electronic Components
2 ________ Electronic Instruments and Equipment
3 ________ Electronic Systems
4 ________ Electronics Computers
5 ________ Research and Development Services

Other, please specify

6 ________
7 ________
8 ________

100%

Give the following employment data for your Greater Boston establishments.

se Column 1 if you wish to report your Greater Boston employment for all of your tablishments taken together.

se as many of the other columns as is necessary if it is more convenient for you report employment by division. If you choose this method, please identify divisions ther by location or principal product or both.

	Total Employment in Greater Boston Area				
	Total for Your Firm (1)	Employment by division (please identify division) (2)	(3)	(4)	(5)
Total Plant Production Workers					
Male					
Female					
Electronic Technicians					
Electronic Engineers					
Other Professional and Scientific Personnel					
Total Women Office Workers					
Total all Greater Boston employment (This figure will normally be greater than the sum of items 1 to 5 above.)					
Total employment a year ago					

. The total dollar value of sales made by your Greater Boston establishments the fiscal year 1961.

$______________________________

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